FLIGHT

The AIRCRAFT ENGINEER AND AIRSHIPS

FIRST AERONAUTICAL WEEKLY IN THE WORLD : FOUNDED 1909

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Editorial, Advertising and Publishing Offices: DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1

Telegrams : Truditur, Sedist, London. Telephone : Hop 3331 (50 lines.)

HERTFORD ST. COVENTRY.	GUILDHALL BUILDINGS, NAVIGATION ST., BIRMINGHAM, 2.	260, DEANSGATE, MANCHESTER, 3.	26B, RENFIELD ST. GLASGOW, C.2.
Telegrams: Autocar, Coventry. Telephone: Coventry 5210.	Telegrams: Autopress, Birmingham. Telephone: Midland 2971.	Telegrams: Iliffe, Manchester. Telephone: Blackfriars 4412.	Telegrams: Iliffe, Glasgow. Telephone: Central 4857.

SUBSCRIPTION RATES: Home and Canada: Year, £1 13 0. 6 months, 16s. 6d. 3 months, 8s. 6d.
Other Countries: Year, £1 15 0. 6 months, 17s. 6d. 3 months, 8s. 9d.

No. 1403. Vol. XXVIII. NOVEMBER 14, 1935 Thursdays, Price 6d.

Wheels and No Wheels

THE announcement of the new arrangements for air services in British Africa, which are to come into force in 1937, make a new and what may be called a political distinction between the landplane and the seaplane. The landplane is to be the class of aircraft for local Governments; the flying boat is to be the air vehicle of the Empire.

As has been already explained in *Flight*, the Short flying boats of Imperial Airways are to fly from England to Egypt and across the Sudan to Kisumu in Kenya, and thence to the coast, which they will follow to the terminus at Durban in the Union of South Africa. At first sight that looked as if a good part of the valuable route through British lands in Central and South Africa would be abandoned, but that is not to be so. There are local lines, some of them affiliated to Imperial Airways, but none the less local, and in these the people of the other colonies take a natural pride. One of these, Wilson Airways, will run a landplane service through Kenya, Tanganyika, and Northern Rhodesia, which will connect with the main Imperial Airways service at Kisumu. Another local company is Rhodesian and Nyasaland Airways, which is also affiliated with Imperial Airways, and it will have an important part to play with its landplanes. From Beira in Portuguese Africa it will connect with Southern Rhodesia and Nyasaland.

The Southern Section

There remains the long section from Southern Rhodesia to Capetown. It has already been announced in *Flight* that Union Airways, which belongs to the Union Government, as do practically all transport organisations in the Union, will run landplanes from Capetown to Germiston near Johannesburg. Between Germiston and Lusaka in Northern Rhodesia there will be two services a week, one by Union Airways and the other by Rhodesian and Nyasaland Airways. The Governments of Northern and Southern Rhodesia will subsidise these services. Thus will local patriotism be gratified by seeing the landplanes of their own country flying over their own country, while the Empire connection with Britain is kept up by the flying boat.

Aircraft in Abyssinia

TRUSTWORTHY detailed reports of the air operations by the Royal Italian Air Force in Abyssinia are scanty, but, so far as can be judged, the aircraft seem to have been used intelligently as an arm of the Italian army. There have been no air combats, as there are no Abyssinian aircraft worth mentioning, so the duties of the Italian machines have been divided between reconnaissance and bombardment.

As might have been expected, both of these operations have been more simple when carried out over level plains than when the Abyssinians have retreated to the mountains. Even on the plains of Ogaden in the southern area it would not have been impossible for considerable forces of the defenders to have concealed themselves in the scrub, but the strategy of the defence has been to let the Italians become involved in the mountains before making any serious resistance. On the whole, the Italian air reconnaissance has told the Generals that their next step in advance would not be opposed by any large defending force, and such information is what every General always wants to know.

Once aircraft have to work over mountains, their difficulties increase. They have to survive disturbing air currents, and, if mechanical trouble should develop, they must not expect easy landing grounds.

Air bombardment is of very little effect except when directed against concentrations of troops or fortresses. On one or two occasions the Abyssinians have been so ill-advised as to mass into small towns in the mountains,

and then the aircraft have taken up the duties of artillery and have bombarded the position until the way of the infantry has been made easy. Such action is the proper function of bomber aircraft.

Thin-skinned

TWO facts of particular interest emerge from a perusal of the 1934-35 annual report of the Aeronautical Research Committee, a summary of which appears on pages 498-500. As the speed of aircraft increases and parasite drag is reduced, skin friction may account for the major portion of the drag. Recent experiments have shown that excrescences of a few thousandths of an inch may appreciably increase the profile drag of the wings of a high-speed aeroplane. The committee gets in a quiet dig at certain members of the aircraft industry with: "in the earlier period this work may have appeared to be of academic interest only."

Closely connected with the subject of skin friction, although having its origin in other desiderata, is the construction of thin metal-clad components such as wings and fuselages. If flush-riveting is used, the surface of such a structure is about the smoothest obtainable, and designers are turning more and more to the *monocoque*. The report bears evidence of considerable activity in the evolution of basic data for use by designers, but, in view of the amount of work on similar lines carried out abroad, notably in the United States, one cannot help feeling a certain amount of surprise at reading, in the report of the Structure Sub-Committee, that "At a joint meeting with representatives of the industry held early in the year it appeared that information is urgently required as to the strength of *monocoque* fuselages in combined bending and torsion and under shearing forces. The Sub-Committee therefore decided to postpone further investigation of complete structures in flexure, and to concentrate attention upon the combined effect of bending and torsion."

Metal skin construction is scarcely a novelty abroad, and for quite a long time it has been obvious that British designers would be requiring all the data that could be collected in order to facilitate the design of economic *monocoque* structures. One would hardly expect that it required a meeting with representatives of the industry early in the year to bring that need to light.

Many will welcome the statement in the report of the Aerodynamics Sub-Committee that the Sub-Committee considers that Great Britain should agree to the introduction of the factor "$\frac{1}{2}$" in the aerodynamic coefficients. Hitherto it has been rather a case of "all out of step except our John."

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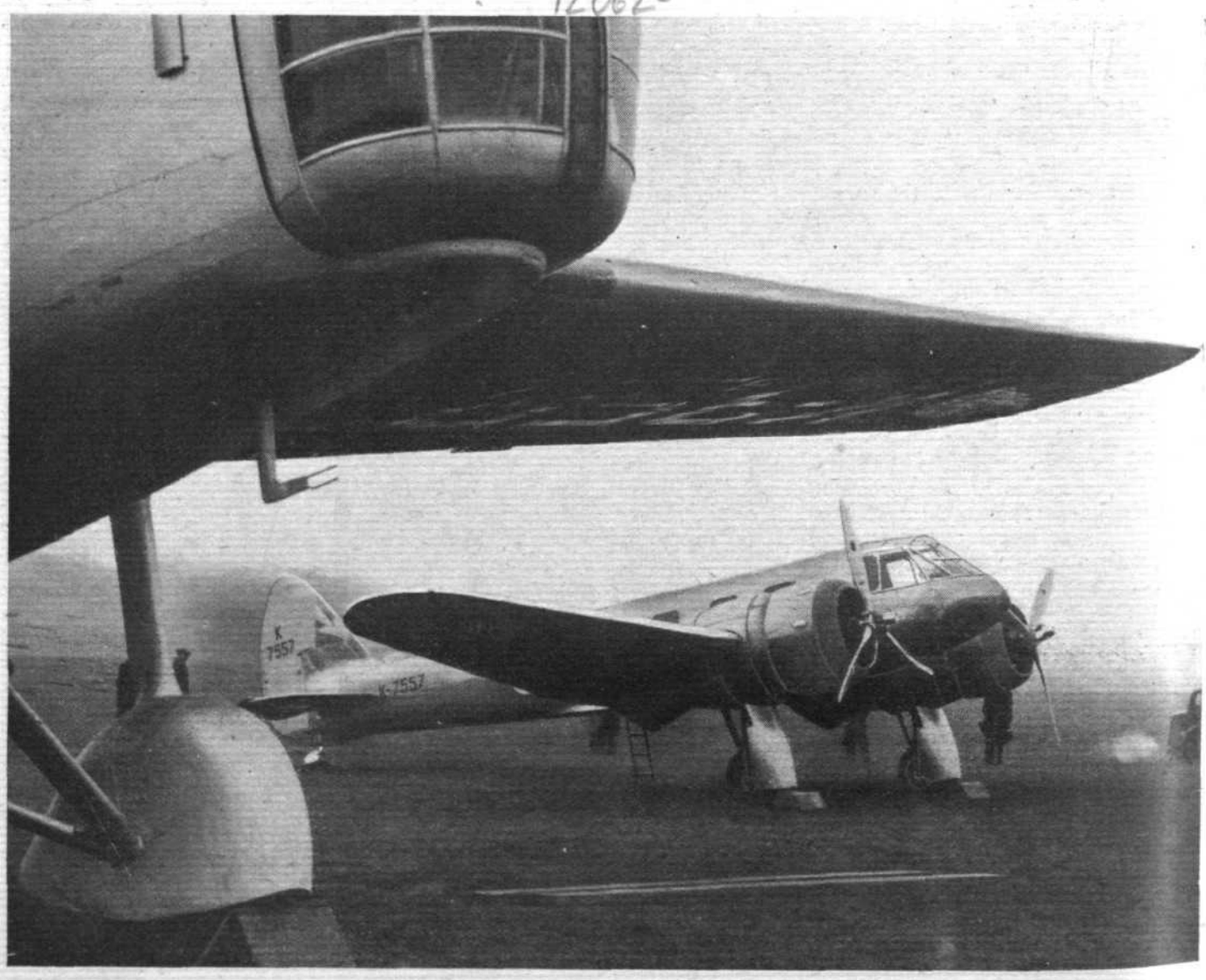


MEDIUM BOMBER AND BOMBER TRANSPORT: The Bristol 142 (two Mercury VI S engines), although a fairly large machine, is dwarfed in this view by the Bristol 130 (two Pegasus III M engines) in the foreground. Other photographs of the 142—which has been credited with a speed of 270 m.p.h.—appear on pages 507 and 514. (*Flight* photograph)

The Outlook

A Running Commentary on Air Topics

Speeding-up

IN last week's issue of *Flight* reference was made on this page, under the heading "Contracting to Expand," to the types of new aircraft being built by different manufacturers for the expanded R.A.F. Just recently a new type has been added to the experimental aeroplanes which in time will take their places as part of the flying equipment of our defence forces. This machine, designed and built by the Hawker company, is a single-seater fighter fitted with the Rolls-Royce Merlin engine, and incorporated in its design is every known aid to performance.

Following the lead given by designers of small civil aircraft, the Hawker designers have chosen the low-wing cantilever monoplane arrangement, which facilitates the use of a retractable undercarriage. The tail wheel also is retractable, and as the pilot is enclosed in a transparent cockpit covering there are no projections of any sort to detract from the speed. The Rolls-Royce Merlin, which follows standard Rolls-Royce practice in the matter of cylinder arrangement, makes for a very "clean" nose, and altogether the new machine is about as neat as it is possible to make it. Mr. P. W. S. Bulman, Hawker's chief test pilot, has made several flight tests, and these are said to have been entirely satisfactory.

It is rather the fashion to talk of the new fighters as 300-m.p.h. machines, not because this is necessarily the figure aimed at, but because it is generally held that, to be of any real use, they will have to do at least that speed. No one knows as yet, not even Mr. Bulman, what the new Hawker monoplane will do, but we gather that its movement is quite perceptible, even without the use of "sighting sticks"!

"Selling" Air Travel

IN the course of his recent lecture on air transport (see *Flight* of November 7), Lt.-Col. Shelmerdine gave a number of possible explanations of the fact that the general public is not patronising the internal air services to any great extent. He did, however, fail to mention one very important reason.

Several times during the past year *Flight* has commented on the fact that the general public simply does not know how to use air services. For several very good reasons the business-man-in-the-street is almost entirely ignorant of the services that are available to speed up his movements from place to place. Anyone who has tried the experiment of asking friends and acquaintances, both inside and outside the aircraft trade, must have been appalled by the ignorance and indifference displayed.

The ordinary travel agencies are, of course, precluded from booking passages on or giving information concerning any air services other than those of Imperial Airways, Railway Air Services, and sundry foreign air lines with useful connections.

The individual operators cannot afford to advertise nationally, and, in fact, one hardly sees posters or pamphlets save at the various aerodromes.

Several very excellent time-tables can be purchased for a few pence apiece, but the existence of these is not always realised even by quite ardent air travellers. The number of telephone enquiries made through *Flight* alone gives a very fair indication of the prodigious ignorance of the general public.

For the present it remains, therefore, for interested persons, such as club members and people in the trade itself, to carry out an extensive "go by air" campaign. Everyone who has the missionary spirit in this matter of flying should have a very fair knowledge of the routes and operating companies in this country, and should make a point of telling people about them.

Instrument Segregation

NOTHING that will simplify the commercial pilot's work should be left undone, and the U.S. Bureau of Air Commerce is to be congratulated on making an effort to standardise the instrument panels of transport types. Pilots even of light aeroplanes know how difficult it can be for them when leaving one machine for another with a totally different panel lay-out.

The need, however, to us appears to be for more rigorous grouping or segregation rather than for standardisation. A great deal has been and is being done in this direction, but machines are still to be found with the most oddly disposed array of instruments. For reasons, no doubt, of installation simplicity, instrument panels are sometimes seen with the less necessary dials scattered magnificently among those of vital importance.

Surely the blind-flying instruments, the altimeter, the rate-of-climb indicator, and the air-speed indicator should always be grouped on a separate panel, which is so placed and arranged that the pilot has the least difficulty in re-focusing his eyes after glancing at the ground. Revolution indicators, temperature gauges and the like should themselves be grouped in order of importance, so that the pilot may see at once when one or other is showing a different reading during his occasional checks. The American system, whereby all the needles are horizontal at normal cruising speeds and heights, might, too, be copied here.

Assault

"ONE man, one machine, one bomb" is a creed which has been in circulation for some years, but which has found no practical devotee. Its exponents maintain that a flock of small fast machines, with a pilot and a bomb apiece, could be usefully employed for making rapid attacks on enemy targets, particularly on troops.

The Americans have their "attack" machines—fast "ground strafers"—but they are two-seaters; the latest effort of the Curtiss Company in this field is, in fact, a twin-engined type, and may carry an even larger crew.

Italy is developing what she calls the *aeroplano d'assalto*, and a number of firms have built machines of this type. It appears that they are aiming at an aeroplane with a speed equal at least to that of the best two-seater fighters, carrying, should the nature of the target demand it, just the pilot and a single heavy bomb, or, for ground strafing, a heavy machine-gun armament, and perhaps small bombs. Later machines of the class are being stressed for dive bombing.

Presumably, when attacked by enemy fighters from which he could not fly away, the pilot of such a machine would be compelled to use it as a single-seater fighter, although handicapped by its size and weight.

It seems that these machines are being designed so that they may, if necessary, be converted into two-seater fighters or fast single- or two-seater reconnaissance machines.

Certainly the *aeroplano d'assalto* is an interesting type, and, being highly mobile and versatile, could obviously be used with great effect in guerilla warfare.

A YEAR of RESEARCH

Some Notable Points from the Aeronautical Research Committee's Annual Report : The Importance of Clean Design : Securing Low Landing Speeds : New Lateral-control Devices : Importance of Structural Stiffness : 200-ton Flying Boats?

RARELY in the history of flying has there been a period so full of interesting technical developments as that through which we are passing at the present time, and the prospects for the near future are full of promise. The reports issued annually by the Aeronautical Research Committee are concerned mainly with achievements of the past, but they also serve as a guide to the future by the outline which they give of problems still to be solved. While not minimising the serious character of much which still remains to be done, the A.R.C. annual report for 1934-35, issued recently, rewards the careful student of its pages by the evidence of progress which they reveal, and by the nature and character of the problems which are to be attacked in the immediate future. In the following review of the report some of the more interesting phases of British research are dealt with.

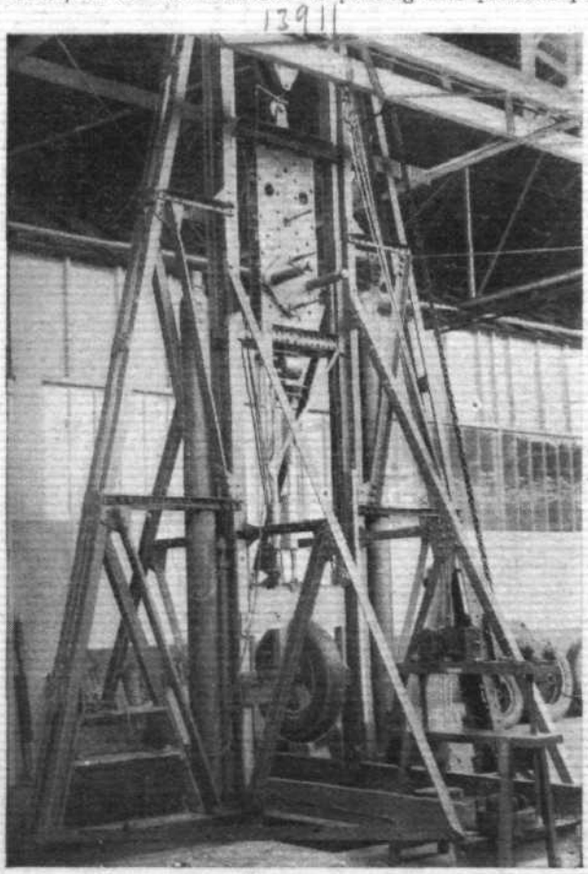
Increased Performance

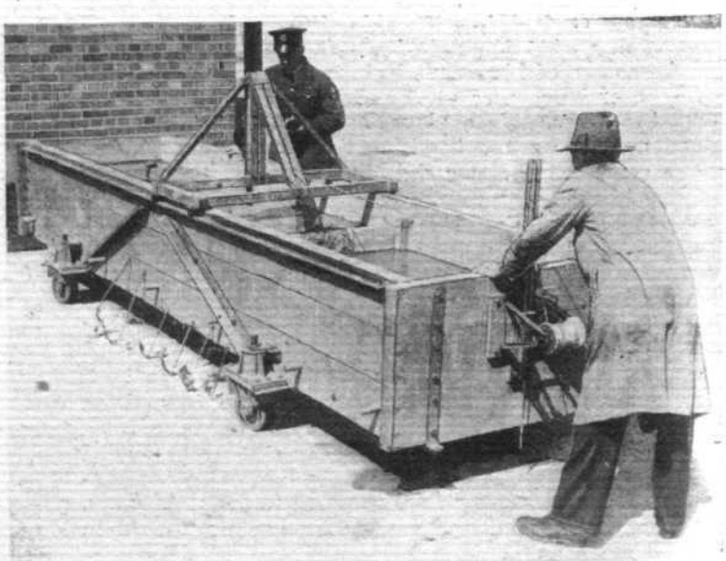
As in previous years, the report is divided into two parts, of which the first is the report of the Aeronautical Research Committee, while the second, in the form of a supplement, contains reports by the various sub-committees and panels which deal with specific subjects.

A marked increase in the general performance of aircraft having taken place during the last year or so, one looks for an explanation and finds the following reference on the very first page of the report: "The winning machine "[in the Mildenhall-Melbourne race], " the D.H. Comet, which was specially built for the race, was a small monoplane of exceptionally clean form. . . . It may well have appeared to the layman that some new discovery in aeronautics had been the main cause of this sudden jump in the speed and range of commercial aircraft. In fact, no new discovery has contributed to this result, which has been due to putting into practice principles which have long been clearly established. The importance of clean design; of avoiding interference of one part of the structure with another in the airstream; the advantages of variable-pitched airscrews and of retractable undercarriages, have been recognised for many years."

The report states that substantial improvements in aerodynamic design are still possible, and points out that the A.R.C. has devoted much time to investigations on interference, skin friction and flutter. In the early period of this work, the report states, many may have regarded it as being of academic interest only, and while aircraft were of low performance it was of secondary importance. So long as parasitic resistance was high skin friction was not of great importance, but it seems clear that in future skin friction will account for the major portion of the drag of high-speed machines. smoothest surfaces appear to have a drag which approaches very closely in value to the frictional drag of a flat plate with a turbulent boundary layer. The profile drag is constant up to large lift coefficients if the surface be smooth. The attention of designers has been drawn, in a note by Miss Bradfield, to the importance of avoiding designs which involve "expanding air channels" between the various parts of an aeroplane in order to keep interference drag down. In a paper before the Royal Aeronautical Society read some years ago by, we believe, Mr. Ower, attention was drawn to the same fact. The lecturer then referred to "divergent air flow."

It is interesting to learn from the report that at Cambridge University Professor B. Melvill Jones is to be provided with better equipment for his investigations into stalling, and that this will include the use of pitot tubes to supplement wool tufts in the study of air flow. Aeroplanes to be used in the study include the Atlas, Hart, Courier, Siskin, Fury and Comet. The pitot tubes will provide a more exact method of exploration of the regions in which there is a loss of total head of air.





(Left) At the Royal Aircraft Establishment they have a machine for carrying out dropping tests of aircraft wheels and tyres, the height of drop and loading on the wheels being chosen to represent the impact of an actual landing.

(Above) The behaviour of flying-boat anchors of various types is studied at the Marine Aircraft Experimental Establishment, Felixstowe, in a tank of mud. The model anchors are drawn along, and the degree to which they dig in is noted. Some types can literally be put into a "spin" as they drag. One type of anchor evolved has far greater holding power than the ordinary fluke type, yet is extremely light. (*Flight* photographs.)

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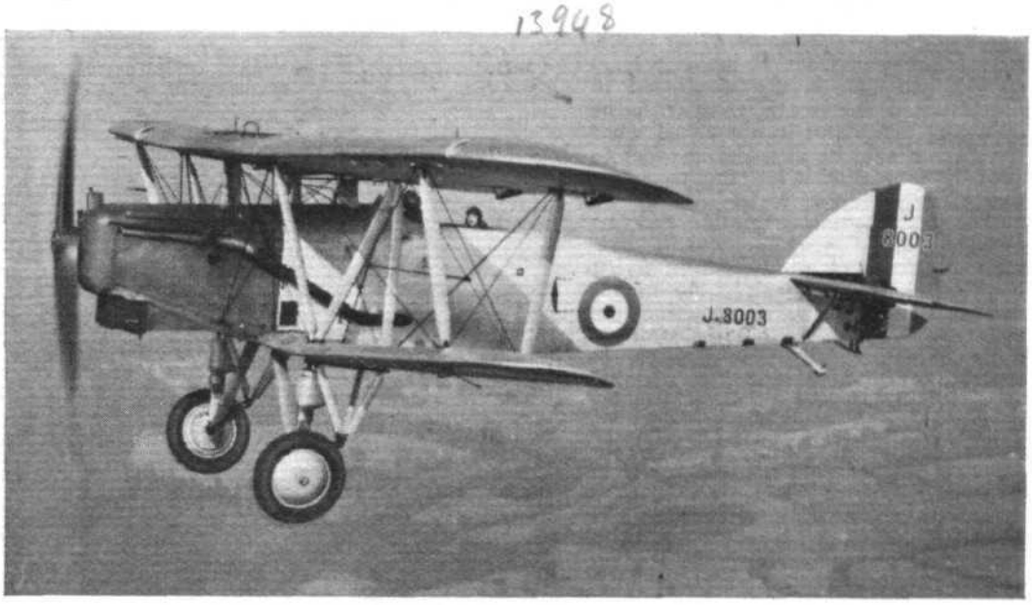

A Rolls-Royce petrol engine, converted into a compression-ignition unit, undergoing flying tests at the Royal Aircraft Establishment, Farnborough. (*Flight* photograph.)

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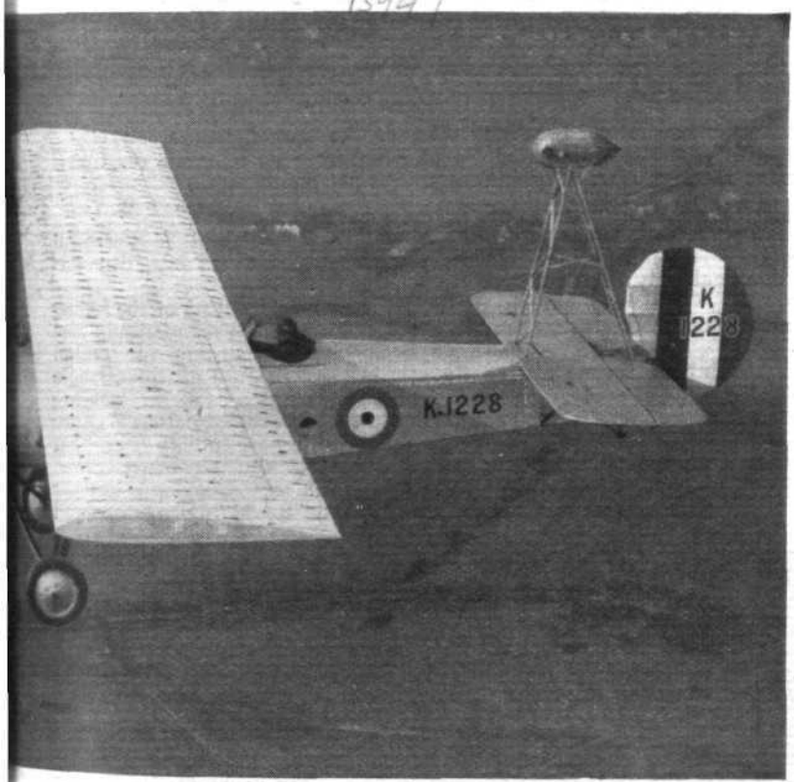


Air-flow study at Farnborough: An automatic camera mounted above the tail of this Parnall parasol monoplane films the movements of tufts of wool attached to the wing. (*Flight* photograph.)

High wing loading is essential for high speeds, and investigations are now in progress for providing designers with data for evolving the best form of device for slow landing. Reference is made to the "Zap" and other split flaps, and the Parnall monoplane with a floating wing mounted on a dynamometer is about to be used for full-scale tests. In the compressed-air tunnel (usually known as the CAT) all flaps tested show a sudden stall, but the full scale tests so far made do not quite bear this out. Another promising device, the report states, is a slotted flap under development by Handley Page, Ltd. This type of flap, it is thought, may have special advantages for take-off, as an increase of lift is obtainable without the high drag associated with split flaps. The extra drag, of course, greatly facilitates landing.

When normal ailerons are used full advantage cannot be taken of flaps, as these cannot then extend over the whole span. Floating wing-tip ailerons have been tried, and give results which are, if anything, better than conventional ailerons. They have, however, three disadvantages in that they decrease maximum lift and maximum lift-drag ratio, and they are heavy in operation. "Spoilers" on the leading edge retain rolling moment up to the stall, have favourable yawing moments, and are structurally simple, but in America it has been found that they show a "lag" between the application of the control and the response of the aeroplane.

Experiments with "interceptors" (the interceptor is a form of spoiler) connected to the rudder instead of to the ailerons have shown that this is the best form of lateral control at low speeds that has yet been obtained.

The Americans use the word "tab" to denote a very small surface let into the trailing edge of a control surface and hinged thereto. The A.R.C. terms this type of surface a "balance flap," and the report states that at present there is a tendency to abandon the servo-rudder or servo-flap system, which suffers from flutter and has to be carefully mass-balanced, in favour of the balance-flap. The difference is that with a balance-flap the pilot operates the main rudder and the flap acts as a balance, while with a servo-rudder he operates the servo-flap, which in turn actuates the rudder.

In connection with flutter and mass-balancing, the report expresses the opinion that irreversibility of the controls seems to hold out most promise, but pilots object to it because they lose the "feel" of the controls.

"Geodetic" Construction

Constructional progress and problems are covered in the report by references to the Wallis "geodetic" type of construction, to the problems of thin sheet construction, to pressures on the bottoms of flying boat hulls, and to the importance of stiffness of construction no less than structural strength.

Of the Wallis "geodetic" construction the committee says: "Mr. B. N. Wallis, of Messrs. Vickers (Aviation), Ltd., has broken away from conventional methods of design and has developed a new form of 'geodetic' structure which combines lightness with great strength and torsional rigidity. We have followed his work with interest and attach great importance to it. The torsional stiffness of wings designed on his system is high in relation to their stiffness in bending. Such a disposition of relative stiffness is likely to be of advantage in avoiding flutter, but it is not yet known how far flexural stiffness may be safely reduced.

Investigation of the strength and stiffness of constructions in thin sheet metal with one or more stiffeners has been continued. A programme of tests on representative structures in combining bending and torsion is to be begun shortly at Bristol, the object being to demonstrate that the strength of the structure need not necessarily be decreased by the presence of a hole which has been adequately stiffened without the addition of much weight. The N.P.L. has devised a theoretical method by which the interaction between thin sheet and stiffeners may be assessed. The analysis has so far been applied only to a simple example, but is being extended to more complicated cases.

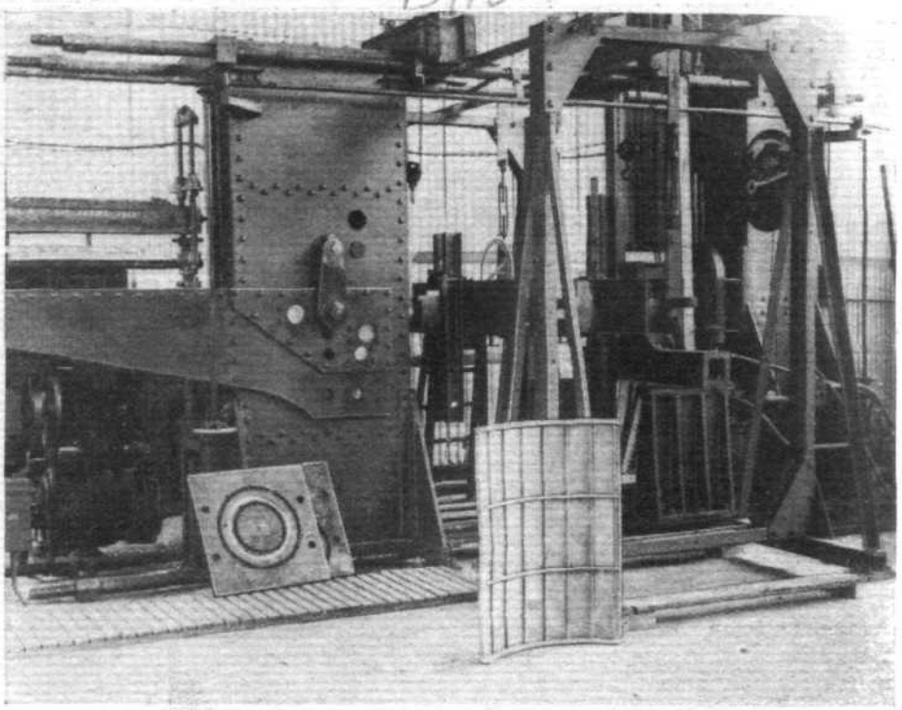
As a result of tests it is concluded that thin sheet cannot be expected to carry any appreciable proportion of compressive load and these must be taken almost entirely by the longitudinal stiffeners.

The most important work on seaplanes during the past year has been the measurement of water pressures on the hull of a Supermarine Southampton. The largest pressures occur just forward of the front step; behind the step the pressures are relatively low. If further work confirms this, some saving in weight may result from careful design.

While on the subject of flying boats, reference may be made to the very large flying boat. As briefly mentioned in *Flight* last week, at a meeting with the operating companies it was asked what problems should be attacked in order to provide information for the construction of very large aircraft. A seaplane appeared to be more suitable for this purpose than an aeroplane, and the possible development of a 200-ton flying boat has been discussed. No fundamental difficulties of construction are apparent as regards either water or air operation, provided the number of engines is not more than six or eight. This proviso, however, means that power of the order of 5,000 b.h.p. must be put into a single shaft. Although in principle there is nothing difficult in this, the details are, it is pointed out, beset with considerable difficulties. The effect on aerodynamic efficiency of a number of airscrews along the leading edge is to be investigated on large models in the duplex tunnel at the N.P.L.

Concerning noise in aircraft, the report recalls that fast-running airscrews are the chief offenders. Large-diameter, slow-running airscrews reduce the noise considerably; next comes the exhaust. Two silencers in series, weighing about 50lb. together and exerting a back pressure of only 1½lb., gave a noise reduction of about 25 decibels and reduced the noise of the exhaust to below the level of the noise of engine clatter. It has been found that in a machine having airscrews of low tip speed and a well-silenced exhaust, the noise was nearly the same in gliding flight as in climbing flight. From this fact it is concluded that the noise of the air flowing around an aeroplane may impose a limit to the extent to which silencing of airscrews and engines can usefully be carried. Experiments are proceeding.

On the subject of engine research the report has a good deal to say. Although improvements in the fuel consumption of the petrol engine have postponed the use of the Diesel engine, work is being pursued on the compression-ignition engine. Mr. H. R. Ricardo, working on a two-cycle sleeve-valve C.I. engine for the Air Ministry, has obtained successful running at high speeds, and an output of 32 h.p./litre has already been realised.



Towards metal monocoque construction: One of the curved panels, and the machine in which it is tested, in the course of Farnborough's research on thin metal skins reinforced by stiffeners. (*Flight* photograph.)

Curiously enough, the report makes no mention of the higher octane fuels now used in the R.A.F., and the economies in fuel consumption which have been obtained during the period under review are partly ascribed to the automatic mixture control evolved at the Royal Aircraft Establishment. During three months' trial the saving in fuel has varied between 14 per cent. and 30 per cent., and the report points out that the monetary saving to the R.A.F. will be considerable. Experimental work is to be continued, as the device is not yet entirely satisfactory when applied to highly-supercharged engines.

Apart from economies resulting from the correct mixture obtained with the automatic mixture control, previous work has indicated that a saving could be effected by flying on a weak mixture and advancing the ignition. A saving of 17 per cent. has been obtained in this way, of which 7 per cent. is accounted for by advancing the ignition and 10 per cent. by the weak mixture.

A Westland Wapiti with which experiments in vari-colour paints for camouflage purposes are carried out at the R.A.E., Farnborough. (*Flight* photograph.)

Freezing Cured

The so-called freezing of engines by the formation of ice in the carburetter appears to have been overcome by the use of a special de-icing unit evolved at the R.A.E. The addition of a small quantity of alcohol to the petrol has been found to prevent ice formation, and a device has been produced which detects the onset of freezing and only administers alcohol until the ice has been dispersed. The report points out that direct petrol injection is now beyond the stage of preliminary experiment and that the work is being continued, but that by the prospects of the possibility of eliminating freezing troubles one of the main advantages of the direct-petrol injection system may disappear.

Vertical gusts may have serious effects on fast-moving aircraft, and during the year work has been proceeding on the problem of measuring gust velocities. Measurements have been made with several types of aircraft carrying accelerometers. At home the maximum accelerometer readings recorded were 2.7 g. upwards and −0.9 g. downwards. On the "sharp-edged" gust hypothesis these readings corresponded, on the particular aeroplane used, to vertical gust velocities of 24.9 ft./sec. and 20.8 ft./sec. respectively. In Iraq a maximum reading of 3 g. was obtained, corresponding to 30.8 ft./sec. From readings obtained on small and large aircraft it is concluded that the scale of the atmospheric turbulence found in gusty weather is sufficiently small to have a greater influence on aeroplanes of 30-40 ft. wing span than on aeroplanes of twice that size.

A "TWIN" FROM READING

The New Miles Peregrine Twin-engined Monoplane : Civil and Military Versions : 188 m.p.h. With Two Gipsy Sixes

"BIGGER and better" seems to be the keynote of the Miles development programme. Since the original Hawk design met with such widespread success there have been produced the Hawk Major, with its training and "de luxe" variations, the Falcon and the Merlin. The latest and largest member of the family is the Peregrine twin-engined cabin machine, a low wing monoplane particularly suited to feeder line work, for use as a luxury private owner type, for training in flying multi-engined aircraft, and where a fast economical machine is required for military purposes.

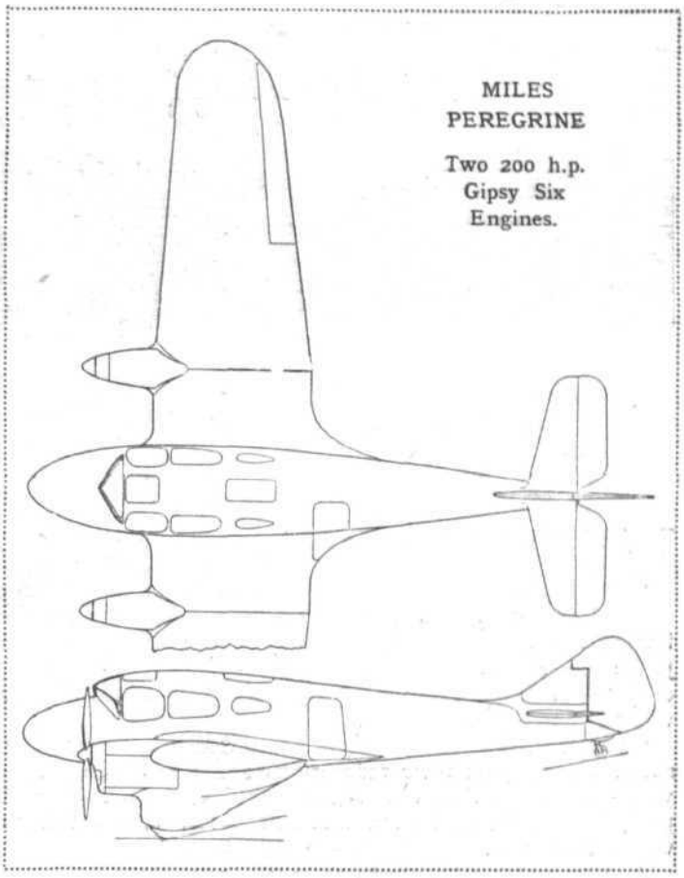
As in previous Miles machines wooden construction is employed. The wings are of cantilever type with two spars and plywood covering which takes the drag and torsional stresses. This ply is specially made for its job, and the method of attachment enables a highly polished finish to be obtained thereby enhancing not only appearance, but probably performance also, due to the reduction in skin friction. It is claimed that the method of construction provides a large "hidden" safety factor, and that the wing covering can be practically destroyed without failure occurring. The factors are in excess of Air Ministry requirements. Inspection covers are provided on the main components for routine internal examination.

Roomy Cabin

The fuselage is a semi-monocoque structure, and the main cabin is unobstructed by shear members or bulkheads. This cabin is 12ft. long, 4ft. 6in. wide, and is 5ft. high. Up to six seats can be fitted in the rear, and there is a large space aft suitable for camera equipment, wireless, and/or drift and bomb sights.

In the nose of the machine, which is sturdy enough to offer protection in the event of nosing over, is a cabin for two pilots. The seats are actually well behind the airscrews, and the undercarriage is placed well forward of the centre of gravity, making for additional safety. One side of the cabin may be hooded for "blind" instruction.

The standard control column consists of a "Y"-shaped member fitted with wheels for aileron control and adjustable fore and aft during flight. "Link" type rudder bars are provided. These give parallel action, and are arranged for easy adjustment over a range of approximately three inches. Powerful rudder bias gear is included for single engine flight. Fore and aft trim is obtained by adjusting tabs in the elevator operated by an irreversible control, and for varying loads lateral trim is adjusted by another tab inserted in one aileron.



Wheel brakes are included as standard, being of the Dunlop pneumatic variety with inter-connected hand and rudder bar control, allowing free movement of the rudder bar in the air and differential control by foot for taxying.

The pilots' seats are adjustable fore and aft, for tilt and for height, and all controls, including those for the engines and flap gear, are duplicated.

A double instrument panel is included, and two complete sets of flight instruments can be specified. Standard equipment includes flap position indicators on the instrument board, the usual engine instruments, A.S.I.s of both the normal and sensitive type, Reid and Sigrist turn indicator, and fore and aft level.

Landing lights of the Harley type are fitted in the wings. These lights are retractable by means of Bowden-wire-type controls operated by the pilot. Navigation lights are included, and for night flying the light intensity on the separate instrument groups is variable.

Split flaps of Miles design, electrically operated but provided with alternative hand control, are normally fitted.

On the standard Peregrine the undercarriage is of the fixed "trousered" type which has proved so effective on previous Miles designs. The pneumatic compression legs have a specially long travel, and ball bearing wheels are incorporated. A compressed-air container, replenished by an electrically driven and automatically controlled air pump, is provided for the brake system and flaps.

Power is supplied by two inverted six-cylinder in line air-cooled engines, either of the D.H. Gipsy Six (200 h.p.) or Napier Javelin (160 h.p.) type. Electric starters operated by push buttons from the pilots' cabin are included as standard equipment.

MILES PEREGRINE

Twin-engined civil or military monoplane
Two D.H. Gipsy Six engines (200 h.p. each)

Dimensions.

Span	46ft.
Length	32ft.
Height	8ft. 6in.
Wing Area	300 sq. ft.
Cabin Height	5ft.
Cabin Width	4ft. 6in.
Cabin Length	12ft.

Weights.

Weight Empty	3,200 lb.
Gross Weight	5,000 lb.

Performance.

Maximum Speed	188 m.p.h.
Cruising Sped (2,100 r.p.m.)	164 m.p.h.
Rate of Climb (Sea Level)	1,100 ft./min.
Climb to 5,000 ft.	5 min.
Climb to 10,000 ft.	12¼ min.
Climb to 16,000 ft.	21½ min.
Absolute Ceiling	23,000 ft.
Ceiling on one engine (fixed-pitch airscrews)	5,000 ft.
Take-off Run (5 m.p.h. wind)	220 yd.
Landing Run (5 m.p.h. wind)	200 yd.
Fuel Consumption (2,050 r.p.m.)	17.5 gal./hr.
Duration (2,050 r.p.m.)	5¼ hr.

Private Flying

Topics of the Day

High Winds

VERY few of the newer owner-pilots and still fewer club members have any real idea of what exactly constitutes dangerous flying conditions. Poor visibility can, so to speak, be seen, and only a professional knowledge of meteorology will enable a pilot to judge the relative probability of dangerously developing conditions. I was thinking of high and gusty winds with or without accompanying rain.

Obviously, a wind which, in gusts, exceeds the stalling speed of any particular machine is going to make things very difficult for the pilot of that machine, though it is still possible for him, if he has sufficient experience, to get down without damage.

A wind which gusts up to 30 m.p.h. can, however, cause a lot of trouble to an inexperienced pilot, and my complaint is that very few club-trained pilots have a chance of obtaining the necessary experience. Almost without exception—and for understandable reasons—clubs wheel all their machines into safety at the least suggestion of a real wind and sometimes on the appearance of the first drop of real rain.

Essential Experience

YET sooner or later even a club pilot may run into unexpected heavy rain or may attempt to bring back a temporarily borrowed machine on a day with half a gale blowing. High winds have been known to arise in quite a short space of time, and, in any case, a cross-country journey from an inland aerodrome to a coastal aerodrome may take a pilot more or less unexpectedly into rough weather.

In the days when the majority of club aeroplanes had fixed axle undercarriages with high-pressure tyres and not too much power to play with, such caution was commendable. It was not always possible to "catch" a sudden loss of lift with the throttle and a pair of split longerons meant that a valuable machine was out of commission for a considerable time.

Nowadays, however, the underworks will stand considerably greater blows and a judicious burst of something like a hundred horse-power should prevent the worst.

Rough Weather Practice

IT seems to me that all instructors might undertake to teach their more experienced pupils how to fly machines on to the ground in high winds and how to make the necessary allowances for it during the circuits.

One particular instructor, who was enthusiastic enough to teach his pupils everything he knew, once gave me nearly an hour's dual in a 35-m.p.h. wind and the experience has been and will be very useful indeed. At least, I was taught how and when to use the throttle to keep a machine just flying while I jockeyed it on to the ground—and how to hold it there while awaiting the arrival of a brace of assistants.

During the circuits the Sutton harness was indispensable; on one steep turn in a machine which was aerobatically inclined a bump put us partly on our back. So I learnt not to make steep turns in very rough weather!

Self-instruction

TALKING of tuition, it will be interesting to see how Mr. Kronfeld's scheme for Drone self-instruction (described on p. 504) works out with averagely intelligent newcomers. Although the Drone more or less lands itself, it will be during the first hold-off and landing that the pupil will be in the greatest danger of breaking the machine.

There is no reason, of course, why he should not be able to glide the machine very gently right on to the ground, and for that matter there is no reason to suppose that he would have any difficulty in judging the height of the undercarriage at a ground speed of 20 m.p.h. or so. When it is dropped on its wheels the Drone stays down.

Nevertheless, any shock is taken solely by a pair of air wheels, and the pupil may either glide it *into* the ground or realise that he was doing so and hoick the machine up so that it stalls on to its tail wheel—to the dissatisfaction of the ground engineer. We shall see.

Necessary Improvements

Undercarriages, incidentally, should be capable of dealing with much more inefficient landings, although the design difficulties are likely to be considerable. There are no less than twenty inches of progressive damping movement in a pair of semi-cantilever legs now being tried out by the Autogiro people. Immensely tall and thin without their fairings, they give the machine a Daddy-long-leg-ish and Wellsian but by no means ungraceful appearance. The movement is superbly smooth and the machine remains absolutely glued to the ground when it is all over.

Any desirable increase in the normal width of an undercarriage is, of course, bound up in the need for folding wings, since hangarage forms such a relatively large proportion of the owner's yearly budget. Nevertheless, after watching a training aeroplane pirouetting on a wing tip during the recent gales, I feel certain that width is almost as important as well-damped movement.

At the point when control is most necessary, the average machine is neither ground- nor air-borne, and the results are sometimes disastrous. All the control movements in the world will not usually save a fully stalled aeroplane when digging a wing tip into the turf.

INDICATOR.

FROM the CLUBS

Events and Activity at the Clubs and Schools

FIREWORKS AND COCKTAILS : November the Fifth was celebrated in traditional manner by Brooklands Air Taxis. Among the many can be seen Messrs. O'Connell, Valetta and Henderson of B.A.T., Mr. and Mrs. Duncan Davies of Brooklands, and Mr. and Mrs. Eric Davis of Lympne.

MIDLAND

Last week Mr. A. B. I. Dick made a first solo and Mr. C. Boreham joined the Midland Aero Club as a flying member. Flying times for the fortnight terminating on November 7 amounted to 35 hr. 10 min. Cross-country flights were made to Braunstone and Filton.

C.A.S.C.

Seven members of the Civil Aviation Service Corps visited Fen Ditton on Sunday and flew some four hours, although the weather once again was very gusty. All Cambridgeshire enquiries should now be addressed to the Secretary of the proposed squadron, Mr. Roberson, of 5, Earl Street, Cambridge.

YORKSHIRE

Three new members joined the Yorkshire Aeroplane Club, and Mr. J. E. Hilton made his first solo. One of the new members was Mr. Percy Illingworth, the Shipley Liberal candidate. Flying time totalled 19 hr. 45 min., though no flying took place on two of the days.

On November 5 the members celebrated in traditional manner, and the evening concluded with a supper in the clubhouse.

HANWORTH

Flying time at the London Air Park Flying Club totalled 27 hr. 10 min. last week and Mr. Hood made a first solo. Seven new members joined.

The dance and firework display at the Country Club on November 5 were very well attended, and credit is due to the organiser of the illuminated part of the proceedings for the way in which this was carried out. The National League of Airmen held a successful assembly at Hanworth on November 4 to inaugurate the start of flying for its members.

NEWCASTLE-ON-TYNE

Some seventy hours' flying was carried out by the Newcastle-on-Tyne Aero Club during the month of October, though the club was closed for instruction for a fortnight while the instructor was away on holiday. The club is still, however, some 300 hours ahead of its total flying time for last year.

About a hundred members were present at the social evening held at the clubhouse on October 20, and on November 5 a Guy Fawkes party and dance were held at the clubhouse.

One of the club members, Mr. G. A. Phee, left Woolsington on October 23 to fly home to South Africa in his Hawk Major. During the last week of the month Messrs. A. R. F. Mackie and J. B. Woodeson made first solo flights, Dr. J. Taylor completed his "A" licence tests, and Mr. E. C. W. Beale obtained his "B" licence.

HERTS AND ESSEX

Mr. A. Harris, the parachutist, has joined the staff of instructors at the Herts and Essex Aero Club. During the fortnight previous to November 6 flying times totalled 84 hr. 54 min., despite bad weather. A first solo was made by Mr. C. F. Tulloch and Miss M. Stewart and Messrs. J. F. Millard, L. Larsen and J. B. Harrison passed the tests for their "A" licences.

Temporary arrangements have been made for the Herts and Essex Aero Club to supply machines and instructors when necessary so that flying facilities may still be available at Abridge aerodrome, where the East Anglian Aero Club have recently ceased their operations. No decision has yet been arrived at concerning the suggestion that the Club should take over Abridge aerodrome.

CAMBRIDGE

Last week three new members joined the Cambridge Aero Club, and Mr. Maufe made his first solo flight. Flying times totalled 46 hr. 20 min.

SOUTH STAFFS

Weather conditions at Walsall last week were very poor, but a first solo was made by Mr. S. P. Tidman. The South Staffs Aero Club has ordered another Mark IV Avian and is expecting to take delivery of it in about a fortnight.

READING

An Air League pupil, Mr. Kidly, started his flying on November 2, and a first solo was made last week by Mr. J. Galloway. The flying time totalled 28¾ hr. Mr. Halley is contemplating a flight to the East in the near future.

LONDON

Five new members have joined the London Aeroplane Club, these being Messrs. D. Prowse, W. C. Robson, H. Wynbrandi, S. A. Hustler and E. A. Robinson. Mr. D. Ross has completed the tests for his "A" licence. The flying times last week totalled 64 hr. 30 min.

REDHILL

During the week ended November 8, 46 hr. 45 min. were flown by the Redhill Flying Club, and Messrs. J. A. Walsh and J. P. Sarjent passed their "A" licence tests. "B" licence night flights were made by A. G. Douglas and D. H. Jorge, and both a blind flying certificate and an R-T licence were obtained by members. During the week Mrs. Grace Brown flew the Club's Puss Moth to Brussels.

TOLLERTON

Fog made flying impossible during the greater part of last week at Tollerton, but Messrs. Simkins, Ramsay-Smith and Lucas, Jun., all made first solos on November 6. Mr. W. A. Martin has now become a private owner and his Miles Hawk is being housed and maintained by the Club.

A Tramp's Party was held at the clubhouse on November 5 with the usual illuminations and supper.

YAPTON

During the month of October the flying time at the Yapton Aero Club totalled 64 hr. 50 min. and eight new members joined the Club. The landing competition, which was held on the 13th of the month, was won by Mr. W. E. Wright.

Flt. Lt. A. L. Duke has been appointed to Phillips & Powis' new training school and Mr. W. J. Alington will take his place. A special winter feature is the new £20 contract rate for "A" licences.

BROOKLANDS

Although the weather has been deplorable club instructional hours totalled 70. Mrs. Grierson, the wife of John Grierson, the well-known pilot, made her first solo flight. Two new members, Messrs. Green and Dudley, are taking a course of instrument flying, and five of the Club's "B" licence pupils sat for their second-class navigators' examination.

Mr. Kronfeld and his Super Drone arrived on Sunday, and fourteen members had the privilege of flying it. The Pou and the glider for the London Gliding Club are now nearing completion in the college, and should be ready in a week or so.

The school closes on December 22 until Monday, the 30th, and the clubhouse opens again on Sunday, December 29.

Private Flying

SOUTH COAST

Weather was bad during last week but the week-end was fine, and of the 19 hours' flying for the week nine were put in on Sunday. Sir George Lewis visited the Isle of Wight on Saturday and Bristol and Cardiff on Sunday morning, returning in time for lunch. New members include Messrs. Willison, Elliston and Llewellyn.

BRISTOL AND WESSEX

A very successful firework party was held on November 5, with night flying on the same evening from dusk until 8 p.m. At 10.30 p.m. a Western Airways Dragon arrived from Cardiff with six passengers—members of the Cardiff Club—who returned to Cardiff by air the same night. Mrs. Douglas Wills, who learnt to fly at Bristol last year, has just taken delivery of a Hornet Moth.

GRAVESEND

Bad weather prevented much flying during the past week but Mr. Preston has passed the flying tests for his "A" licence. Mr. Carter has decided to take his "B." Miss Jean Batten left Gravesend on Saturday for Lympne to await suitable weather.

Two new members, Messrs. Duder and Larke, have joined the school and an aerodrome club is being formed. Application forms can be obtained from the secretary.

ALMAZA

A total of 55 hr. 35 min. was flown during a recent fortnight by the pupils and private pilots at the Almaza flying school. Three new pupils—Mr. Siegre Scotto, Nagib Eff., Iskander Eff., and Mr. F. Beinisch—have joined the school, and Semir Eff., Abbassi Eff., Adly Eff., and Abd El Latif have been successful in obtaining their "A" licences. Night flying has been carried out by G. Ishkhanian Eff., (who made his first solo night flight) and Moh. Hazek Eff. The winner of the last landing competition was Aly Bey Fathy.

RANGOON

Forty hours forty minutes flying was put in on club machines during September, although the school operated only for three weeks of the month due to the absence of the Pilot Instructor. Capt. C. R. D. Gray completed the tests for the Indian "A" licence, and Mr. M. Y. Khan and Mg. Ohn Pe went solo. Mr. J. Nicholson is taking a blind flying course. A total of 23 inches of rain fell during the month

On Friday, September 20, one of the three Rapides which were on their way to the Dutch East Indies failed to arrive on time and an intensive search followed. Eventually news arrived that the machine had made a successful landing on the beach at Hainggyi Island, and petrol was flown out to it in the school's two Moths.

NORFOLK AND NORWICH

Of the three hundred guests who attended the annual ball last Friday, a number arrived by air. During the week-end the 21st Norwich and the Wymondham Rover Scouts paid a visit to the aerodrome and were taken around.

Club flying was suspended on Sunday morning and in the afternoon members of the Comrades of the Royal Air Force were entertained to tea by members who had served in the R.A.F. and R.F.C.

CINQUE PORTS

Record-breaking flyers are again finding Lympne the best place to start their flights. Sir Charles Kingsford Smith left there for Australia and Miss Jean Batten came down prior to departing on her flight to South America in a Percival "Gull."

Strong westerly winds impeded tuition last week, but flying time on Thursday had totalled 47 hr. Messrs. Dean and Fellows, the former of the ground staff and the latter a brother of Mr. George Fellows, have both completed first solos. Miss Stella Rennay Tailyour, former private secretary to the late Mr. Arthur Henderson, has successfully completed all the tests for her "B" licence. Members now have the use of a D.H. Moth Major.

AIR SERVICE TRAINING

At the beginning of October there was an intake of 26 Class Fii *Ab initio* R.A.F. Reserve pupils, who will remain at the school for several weeks.

The school was particularly honoured by enrolling as a pupil the Rt. Hon. the Marquis of Londonderry, K.G., P.C., M.V.O., the former Secretary of State for Air, who received advanced flying instruction from Flt. Lt. Beaumont, the senior flying instructor for civilians. Lord Londonderry was an "external" pupil and flew down for instruction on his own machine; he devoted part of his time to polishing up his flying and learning something of the finer points of the art of flight.

Other students who joined during the month were Mr. A. L. Nelson, Mr. Moore, from China, and Mr. Ten-Bos, of Holland, who is taking an instructors' course, while Flt. Lt. M. M. Hutchinson has returned to take the instructors' and blind flying courses.

Two students qualified for their "A" pilots' licences during the month, and three for the "B," while five others have reached the standard for the "B" licence and are now arranging to take the examination.

The school equipment has been added to by the delivery of a new 18-ft. power boat for use in connection with the handling of the Calcutta flying boats on which the present pilots of Imperial Airways will be trained at Hamble to fly such machines. The existing slipway has been enlarged and moorings laid in readiness for carrying out this important contract.

Two more Cadets, of the latest type 643, will still further augment the school fleet next month.

An Airwork Loss

CAPTAIN V. H. BAKER, M.C., A.F.C., for six years chief instructor to the Airwork School of Flying, is leaving on December 1 to take up his duties as a director of the Martin-Baker Aircraft Company. Captain Baker is an instructor of international repute. With Mr. B. A. Davy and Capt. G. W. Ferguson, he has built up the Airwork School, whose management will be taken over by Mr. Davy, Capt. Ferguson remaining in charge of the navigational side. Everybody wishes the best of fortune for him in his new work.

An Aeroplane for Ten Shillings

AT the end of this year some lucky person will obtain one perfectly good aeroplane for the sum or sums of ten shillings. The London Aeroplane Club—having taken delivery of two more machines in the last month—is raffling a D.H. Gipsy II Moth with a twelve months' C. of A. and the engine completely overhauled.

The machine is fitted with slots, glass screens, and dual control, and will be painted in any colours desired by the winner. The draw, for which there will be a limit of 900 ten-shilling tickets, will probably be made at the club's ball.

Identifying Modern Cars

IT is a common plaint among motoring enthusiasts that cars are becoming so alike to-day that it is difficult to recognise one make from another.

To-morrow's issue of *The Autocar* starts the first of a new series of "heads and shoulders" of cars. These are drawn by the well-known artist, F. Gordon-Crosby, and each—there are sixteen in the first instalment—depicts some famous car's characteristic radiator, bonnet, wings and method of headlamp mounting.

In addition the issue contains a fully illustrated description of the Scottish Automobile Exhibition at the Kelvin Hall, Glasgow, open from November 15-23, and full details of Sunday's Veteran Cars' run to Brighton.

Ground Training

PROBABLY the only serious criticism that has ever been levelled at the B.A.C. Drone concerns the particular high-pitched exhaust note which, though not in the least disturbing to the pilot, might cause some complaint near an aerodrome where several Drones were operating.

Particularly interesting, therefore, is the fact that a Super Drone is now in process of construction at Hanworth with the "upper works" strengthened and modified to take a Carden-Ford four-cylinder water-cooled engine. Not only should this machine—which is being built to the order of Commdr. Dove, of "Cloudring" fame—be extremely quiet, but it should also have a rather more interesting performance. Certainly a Drone which will murmur rather than buzz should be more attractive to a singularly critical general public.

Mr. Robert Kronfeld, in his desire to make possible a new method of instruction for such a simple machine as the Drone, has developed a "ground training kit." This consists of a pair of dummy wings with very large ailerons and with safety wheels at the tips, which are reminiscent of those fitted to the R.E.P. monoplane in the days of long ago.

These wings can be fitted temporarily in place of the "flying wings," and will enable a pupil to learn to taxi tail-down with accuracy, to taxi fast with the tail up, and to make gently banked turns without leaving the ground. The pupil will, therefore, learn to handle the least natural of the controls while travelling in absolute safety. In the later stages of self-instruction the undercarriage wheels can be arranged well inboard so that the pupil, while taxying fast, will learn to use the ailerons for balance and so will be able to correct lateral movements quite instinctively once he is launched properly into the air.

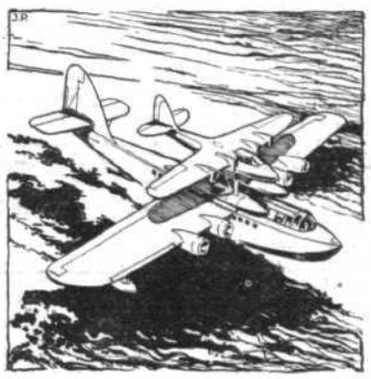
Incidentally, the new insurance terms suggest that the underwriters believe in the safety of the Super Drone. A full comprehensive policy costs only £20 annually, while third party risks are covered for £5. In the case of clubs the comprehensive policy is a matter of £25, and the third party policy is £7 10s. There is a £5 no-claim bonus for either of the comprehensive rates.

COMPOSITE AIRCRAFT

Part II : Some Practical Problems Encountered in the Revolutionary Short-Mayo Scheme

By C. M. POULSEN.

LAST week (pp. 476-478) we examined the fundamental reasons why greatly increased range is obtainable by using very high wing loading and designing for landing at comparatively low weight (as at the end of a long flight). It was concluded that for an aircraft designed to cruise at more than 200 m.p.h. it might be possible to double, or even more than double, the range obtainable with an aircraft of more orthodox operating characteristics. The following notes deal with some of the problems connected with the flight of a composite aircraft such as that invented by Major R. H. Mayo and now in course of construction at the Rochester works of Short Brothers for Imperial Airways, Ltd.



One does not need to speculate very long on the question of composite aircraft to discover that the subject bristles with problems, nor that there are several solutions to each of them. The first thing to be decided is whether the carried aircraft should be below or on top. One's first impulse is to think of "dropping" the carried machine, but this is soon abandoned when it becomes evident that the long-range aircraft would then have to have an undercarriage sufficiently strong or buoyant, according to whether it is to be an aeroplane or a seaplane, to support the combined weight of the two. This would mean a greatly increased structure weight and drag, and is obviously not practicable.

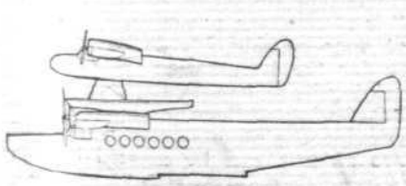
Separating the Two Components

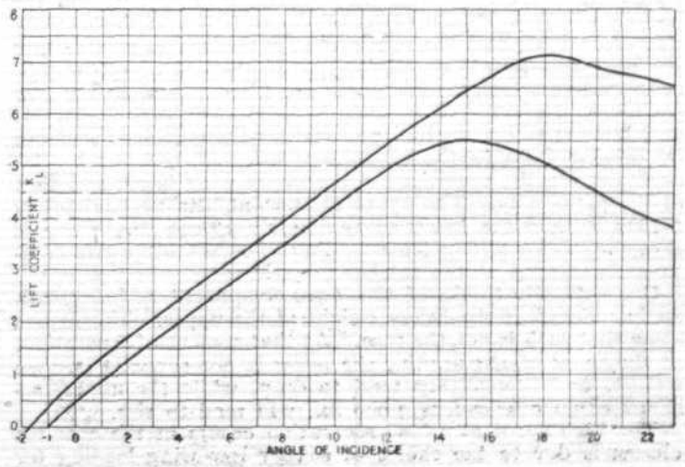
Putting the carried aircraft on top at once raises the question of how to ensure separation. Above we have a heavily-loaded aircraft while below there is a lightly-loaded machine; how, then, can the two be separated in flight? If we think of the composite aircraft at the moment of take-off as an unequal-span biplane, with four engines on the leading edge of the upper wing and four more along the leading edge of the lower wing, the aircraft is not radically different from some that have been very successful in service. For example, the Handley Page Hannibal class has two engines in the top plane and two in the bottom. The main change, therefore, is the doubling of the number of engines and the reduction in span of the upper wing as compared with the lower. Fundamentally, therefore, there is no reason to expect much trouble from the two machines while they are joined together to form a composite aircraft.

Usually it is easier to form a picture from a concrete example than from abstract arguments, and for a starting point we may, therefore, choose certain quite arbitrary figures for the two components of the composite. These figures will not represent the actual weights and characteristics of the Short-Mayo composite aircraft, and are merely intended to form a basis for certain calculations intended to show how the composite principle may work out.

It is known that both components of the Short-Mayo will be four-engined types, and that the upper is to have a very heavy wing loading. By way of an example, let it be assumed that the loaded weight of the upper component is 21,000lb., and that the wing loading is to be 30lb./sq. ft. This gives a wing area of 700 sq. ft.

The flying boat which is to form the lower component is meant to be capable of being operated independently in a way that will enable it to "earn its bread and butter." Also, it has to carry the whole weight of the composite aircraft on the water, and a large proportion during the take-off and climb to the operational height. It must obviously be a fairly large machine. While acting as a carrier, however, it will not, of course, carry any useful load other than the fuel necessary to reach the operational height and to return to its base. Thus it is not unreasonable to assume that its weight may be somewhere in the neighbourhood of that of the upper component. It may be more or it may be less; that is immaterial for the purpose of our examination of the problem, and it will be assumed that the weight is also 21,000lb. The wing loading will be light, and may, for the purpose of this argument, be guessed at 10lb./sq. ft. This figure, allowing for a disposable load of some 60 per cent. of the tare weight, would mean a wing loading of 16lb./sq. ft. when the machine is operating independently and carrying its full pay-load. On these assumptions, the wing area of the lower component will therefore be 2,100 sq. ft.





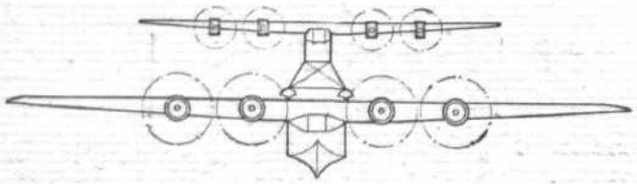
(Left) The variable incidence method of separation. (Right) Two lift curves that can be used to ensure separation when different sections are employed.

A Hypothetical Case

With the assumptions made, we are now in a position to make certain estimates of performance. In what follows, no account will be taken of biplane effect, nor of the reduction in air density at the altitude at which separation of the two components may be expected to take place. Extra wing loading due to down-loads on the tails of the two aircraft are also refinements which need not enter into our considerations, although when actually designing the two aircraft such questions, and many others besides, are naturally included.

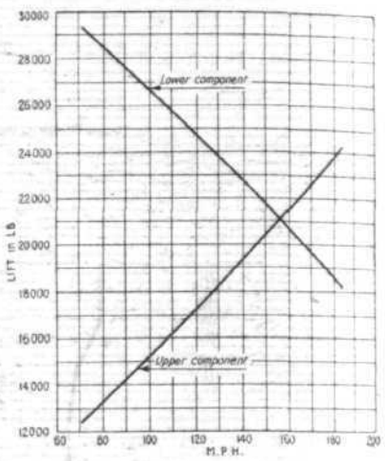
If we assume a maximum lift coefficient of 0.6 for the composite aircraft (the wing sections of upper and lower components being assumed to be the same), the take-off speed, for a total weight of 42,000lb. (21,000lb. for each component) and a total wing area of 2,800 sq. ft. (700 sq. ft. upper and 2,100 sq. ft. lower), will be approximately 70 m.p.h. Having assumed the same wing section on upper and lower component, and disregarding biplane effects, the two components will obviously share the total load between them in proportion to their respective wing areas, so that at the moment of take-off the upper will lift 10,500lb. and the lower 31,500lb. With the same wing sections on upper and lower components, this sharing of the total load will remain the same throughout the speed range of the aircraft, and at no time will there be any tendency for the two components to separate.

If the angle of incidence of the upper component were to be set at an angle larger than that of the lower, it may be imagined that at high speed a separating force might arise, but it is quite obvious that permanent *decalage* (as a difference in angle



(Left) Diagrammatic front elevation of composite aircraft. The c.g. position and the centre of thrust should coincide fairly well with the centre of resistance.

(Right) Curves showing the gradually changing distribution of lift between the upper and the lower components as the speed increases. At approximately 156 m.p.h. each component just carries its own weight. At greater speeds there is a tendency for the components to separate.



of incidence of the two planes of a biplane is called) would narrow down the range of speeds, since the upper wing would reach its stalling angle before the lower, and conversely at the high-speed end of the scale the lower wing would reach no-lift angle before the upper.

An alternative at once presents itself: mount the upper component in such a manner that, when it is desired to separate, its angle of incidence can be increased and the extra lift obtained at the high speed at which the machines would then be flying used to lift the upper component off the lower. This is, in fact, one of the methods patented by Major Mayo.

The neatest way of ensuring separation of the two components would be one in which the aerodynamic forces on the two machines ensured that the necessary force should be present. Actually, this is possible, but the method is not nearly so obvious as the variable incidence method. Wing sections differ a good deal in their characteristics. Some have a high maximum lift, others a lower. Some reach stalling angle at greater angles than others, and some have a large negative angle before they lose their lift completely, while others lose their lift at a small negative angle, or even at no angle (a symmetrical section, for example). By making use of these characteristics of wing sections it is possible to choose a pair which will ensure separation at high speed. The fundamental essential is that the lift curve of the upper section should have a wider angular range between maximum lift and no lift than that of the lower.

One of the diagrams shows two such lift curves. The high-lift section reaches a maximum lift coefficient of 0.71 at approximately 18 deg. angle of incidence, while the low-lift section has a maximum k_L of 0.55 at about 15 deg. incidence. For maximum efficiency at take-off the two sections should reach their maximum lift at the same time. The upper is, therefore, set at a permanent angle of incidence 3 deg. greater than that of the lower wing.

Sharing the Load

With these two lift curves as a basis, and still assuming 21,000 lb. weight for each component, and 700 sq. ft. wing area for the upper and 2,100 sq. ft. for the lower, it is possible to calculate the amount of lift of each component at various speeds. To do this use is made of the fundamental aerodynamic formula Lift = Weight = $k_L \rho A V^2$, in which k_L is the lift coefficient ρ the density of the air (0.0051 when the speed is in m.p.h.), A the wing area and V the speed.

At a lift coefficient of 0.71 and a wing area of 700 sq. ft., the upper component will lift 12,650 lb. at a speed of 70.5 m.p.h. At the same speed the 2,100 sq. ft. of the lower component will, at a lift coefficient of 0.55, lift 29,350 lb. These figures correspond to a lift of 18.25 lb./sq. ft. for the upper and 13.7 lb./sq. ft. for the lower component respectively. Thus at the take-off the lower component is carrying the whole of its own weight and about 40 per cent. of the weight of the upper component.

At a speed of 156 m.p.h. and lift coefficients of 0.24 and 0.08 respectively, the upper component lifts 30 lb./sq. ft. and the lower 10 lb./sq. ft. In other words, each is carrying exactly its own weight, and the relationship is neutral as regards any tendency to separate or otherwise. If a speed of 156 m.p.h. or more is attainable with the power plants fitted in the two machines, separation is possible in level horizontal flight. If not, there is still a possibility of making the machines separate by driving them to the requisite speed. At 184 m.p.h., for example, the lift coefficient of the upper wing is 0.2 and that of the lower 0.05. The upper component lifts approximately 24,000 lb. and the lower approximately 18,000 lb. There is thus available a strong force tending to separate the two components as soon as the catches are released.

One naturally thinks of the lower component as being suddenly relieved of the heavy weight of the upper. The figures show that such is not the case. At the moment of separation, at the speed of 184 m.p.h., the lower is not carrying its own weight, and it will thus tend to drop, while the upper, relieved of an overload of 3,000 lb., will tend to rise.

The high speed at which separation occurs in the example chosen is due to the choice of a very low wing loading for the lower component and to the particular wing sections used. A different combination would give a considerably lower separation speed.

With reference to the actual mechanical details of the gear employed for locking and releasing the two aircraft, there are obviously almost innumerable ways in which these catches and locking devices can be arranged.

One "Skipper"

Imagine the two aircraft locked together and with the eight engines "ticking over." It would seem to be necessary to arrange for all the engine controls to be manipulated by the pilot of the lower component. (The expression "you have got her" assumes a new significance in a composite aircraft.) The flying controls of the upper component are locked in the neutral position, and the upper pilot is, in fact, little more than a passenger until the time for separation comes. The lower pilot is in charge of engine controls and lower component flying controls. He "skippers" the take-off and climb.

When the operational height has been reached (the long-range aircraft being assumed designed to fly high and to use supercharged engines) the lower pilot flattens out his climb and the composite begins to gather speed. One can imagine dials indicating the lifts of the two components throughout the flight, and when the lower pilot sees that there is a sufficient separating force he pulls a lever which releases his part of the catch that locks the machines together.

The pilot of the upper component is advised by signals of the fact that the lower pilot has released his catch. He, in turn, pulls his lever, and finally an automatic catch, operated when a certain pre-determined pull is exerted, releases the machines. They separate, the long-range machine to proceed on its way and the lower component to return to its base.

This, briefly, is one way in which the Short-Mayo scheme may operate. Only the primary considerations have been included in the examination. There are, of course, many others. For instance, the question of stability of the composite aircraft is very important. From the fact that the upper component has approximately the same weight at take-off as the lower, while the wing areas are in the ratio of one to three, and the total power of the upper engines is approximately one-half the total power of the lower, one might expect large differences between centre of thrust, centre of gravity, and centre of resistance. Actually, as an examination of the small front elevation diagram will indicate, these distances are not likely to be unduly great. The most serious will probably occur just after the composite has "unstuck" and when the c.g. is high owing to the fact that the lower component carries about 70 per cent. of the total weight. On the water, at rest, the lower aircraft carries the total weight, of course, but oversize wing tip floats will probably easily look after the lateral instability.

It is to be expected that there will be a signalling system by means of which both pilots will know exactly what is happening. What form this will take cannot be stated at present, but good "team work" is obviously a necessity.

The scheme is one of very considerable daring, and one must express admiration for the imagination which Major Mayo has shown in conceiving it, and particularly in realising that by a suitable choice of wing sections, or by the use of slots and flaps, which provide the same sort of advantages, the separation of the two aircraft can be ensured by aerodynamic means.

. . . AND MANY of THEM

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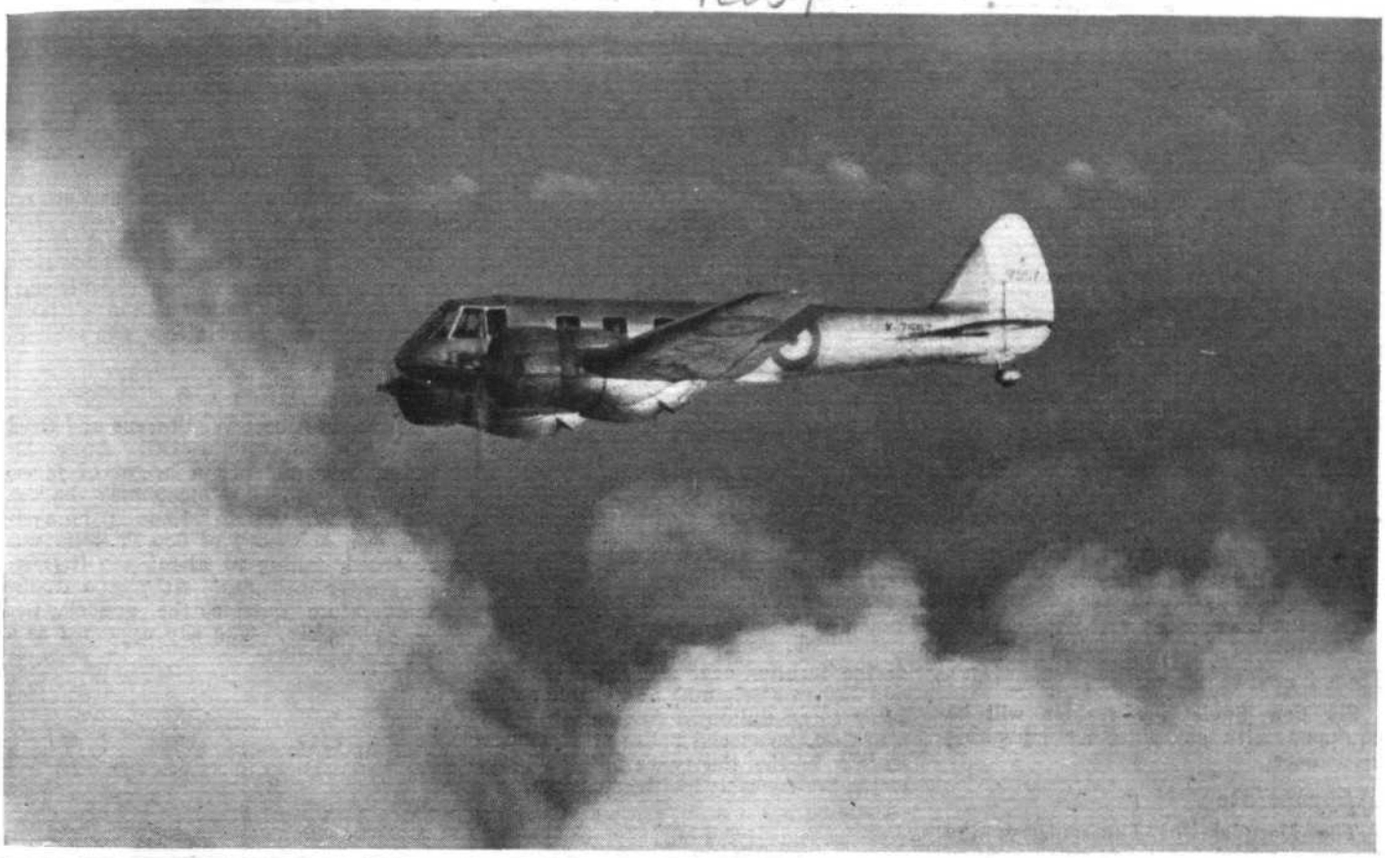
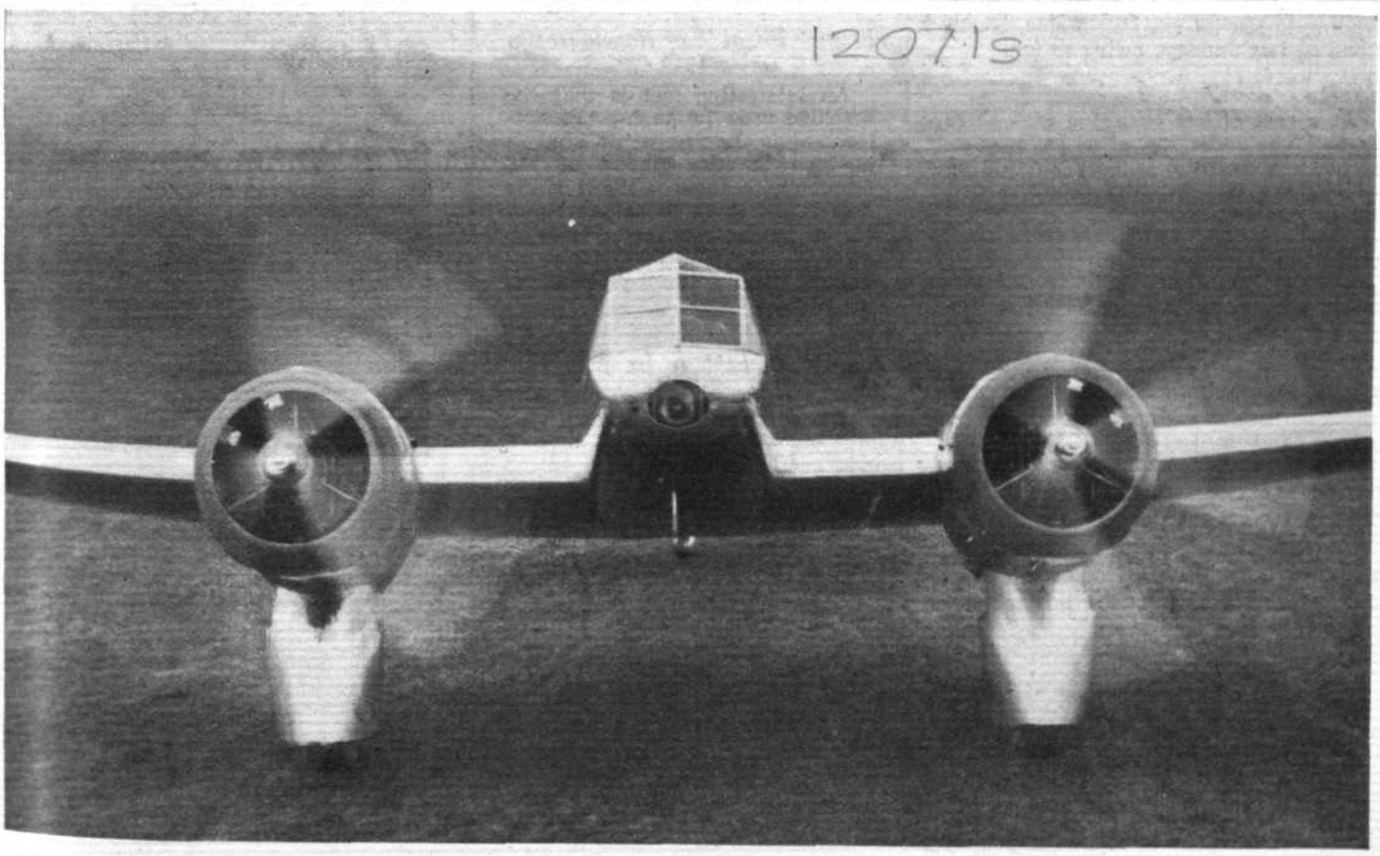




COMING EVENTS . . . . The "shadow" in this case (seen above in the capable hands of Capt. C. F. Uwins) is the Bristol 142 medium bomber (two Bristol Mercury VI S engines). This is the actual machine recently presented to the Air Ministry by Lord Rothermere. A modified version is being built in large numbers for the Royal Air Force. With three-bladed variable-pitch airscrews and a retractable undercarriage this machine has been credited with a top speed of about 270 m.p.h. What the production model will do cannot be stated. Other photographs appear on pages 496 and 514. (*Flight* photographs.)

THE FOUR WINDS

ITEMS OF INTEREST FROM ALL QUARTERS

PURELY DESTRUCTIVE: This is one of the new Italian "assault" machines (actually the Breda 64) whose duty in war time would be to shoot up, bomb, or otherwise destroy enemy *personnel* and *materiel* of every description, including aeroplanes. The pilot is extremely well situated and his machine guns are placed in the wings.

De-icing

Six new Soviet ice-breakers will be equipped with catapults for launching aeroplanes.

Appropriate

The Marquess of Londonderry, the former Air Minister, made an emergency landing in Parliament Hill Fields, North London, last Sunday, owing to fog.

The Holiday Perfect

At a cost of less than £60 each three Cambridge undergraduates have completed a seven-week trip by air, during which they saw fourteen countries and set foot in twelve.

Extended Exercises

Twelve Portuguese military pilots—including Col. Cifka Duarte (the Inspector of the Portuguese Military Air Force), Lt. Col. Ribeiro da Fonseca and Major Pinheiro Corrêa—and six mechanics will form the crews of eight Bristol Jupiter-engined Potez 25 biplanes and a Junkers W.34L, on a training cruise to the Portuguese colonies.

Dirty Work?

According to *Le Jour*, fast motor cars have been picking up passengers set down by aeroplanes on the German side of the frontier near Mulhouse (France) and Eupen (Belgium) and rushing them away to an unknown destination. It is said that the special police at Strasbourg incline to the theory that these movements are connected with espionage.

Twenty-five Years Ago

From "Flight" of November 12, 1910

An interesting fact is that the machine used [a 50 h.p. Blériot-Gnome] is the first of its kind to be sold on the ground of the London aerodrome, while it is the first in existence to be purchased for a purely commercial reason, since it was ordered in connection with the laying of oil pipes across a desert in Persia.

"Hell Divers" à la Mode

The Rome correspondent of the *Paris Soir* states that two hundred Italian pilots have volunteered to dive their loaded bombers on to enemy vessels to make sure of hits, standing no possible chance of getting out of the resulting mess alive. We now await reports of British Naval officers volunteering to be shot from "Archies" at attacking aircraft in steerable shells.

A "Scrap Book" Item

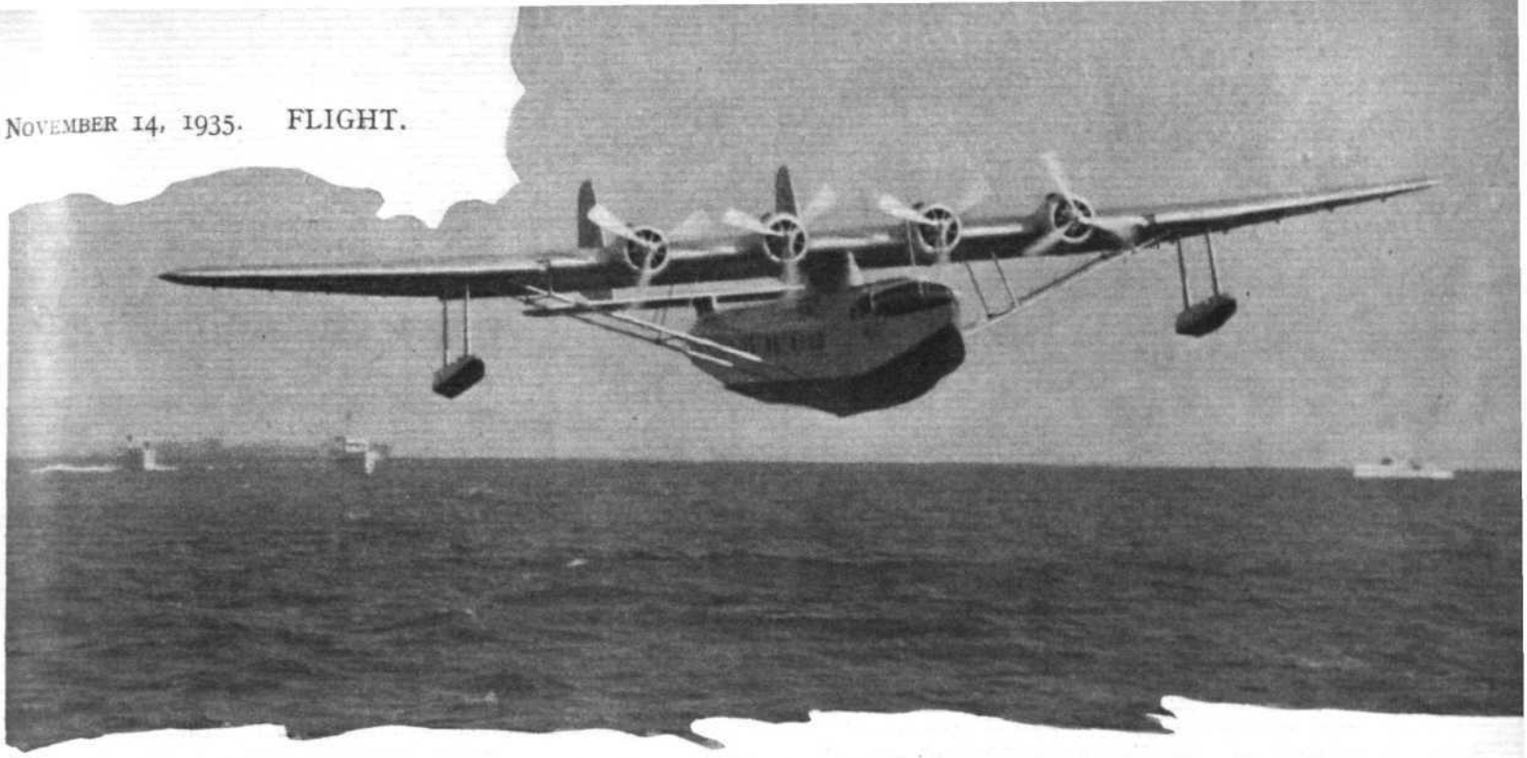
Air Commodore E. L. Gerrard will go to the microphone in the new "Scrap Book" programme to be broadcast from National and Regional stations on November 21 and 22 respectively. The newest "Scrap Book" is for 1911, and Air Commodore Gerrard will describe how, in that year, as a young lieutenant, he broke the world's long-distance passenger record. He flew 129 miles in a Short biplane.

Fourteen Miles Up

Captains Albert W. Stevens and Orvil A. Anderson, of the U.S. Army Air Corps, have reached a height of 74,000 feet in the stratosphere balloon *Explorer II*. Up to 21,000 ft. an average rate of ascent of 600 ft./min. was recorded, falling to about 300 ft./min. at greater altitudes. At 74,000 ft. the temperature outside the gondola was — 55 degrees. The sky appeared as a jet black awning.

THE HIGHEST YET: The gondola of the stratosphere balloon *Explorer II* which, as related on this page, has just reached a height of 74,000 ft. Wireless communication with the ground was maintained throughout the flight.

WINGED WORDS. The 150 ft. Remembrance appeal which was towed over London by a Lynx-Avro piloted by Mr. F. Gordon Freeman. The letters, which are of fabric, with stiffeners in the leading edges, are mounted on tapes. The sign is laid out on the ground, and the pilot then flies over it, picks it up with a hook, and "peels" it off. Aerial Sites Ltd., of Hanworth and London, were the operators.



COMMERCIAL MARINE AIRCRAFT

Is Design Becoming Standardised? : A Review of Modern Practice Abroad Which Would Suggest that Designers are Settling Down to the Multi-engined Monoplane Flying Boat

By H. F. KING

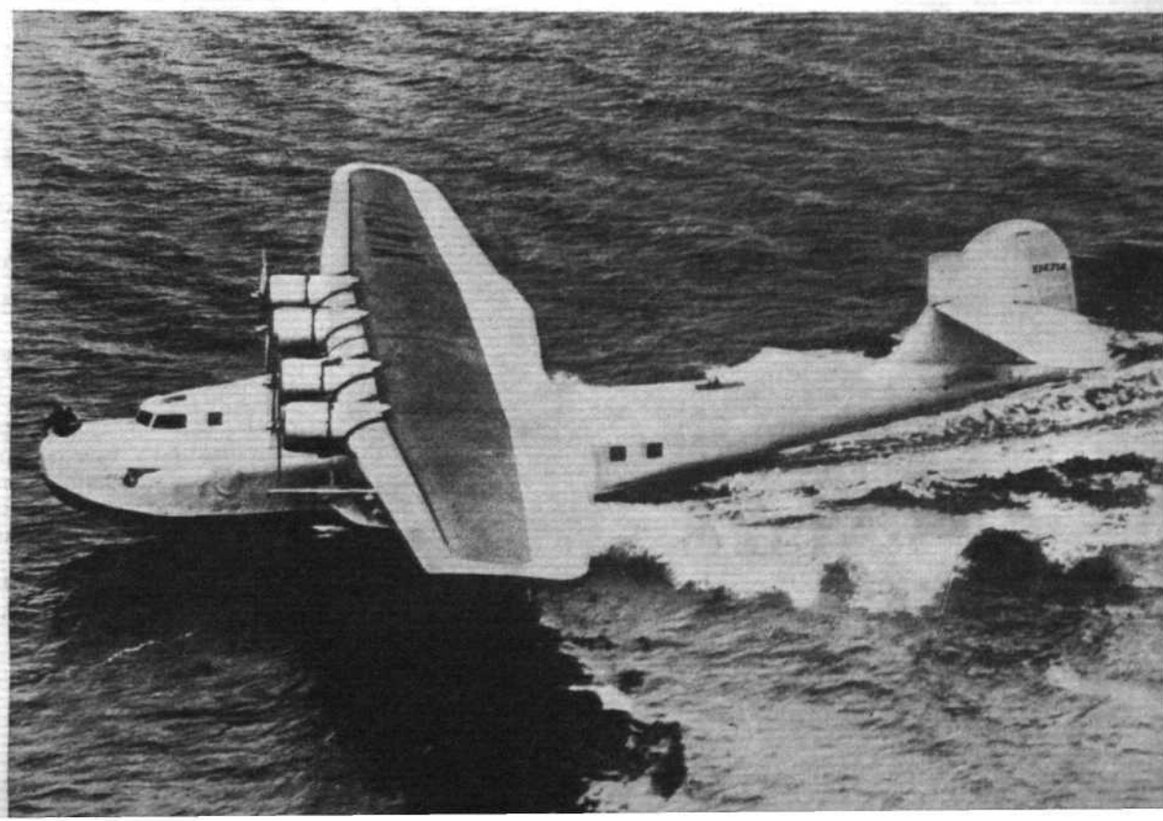
AT the moment an extremely important period in the development of the commercial flying boat is approaching its peak. The pages of *Flight* for a year or two past have borne numerous references to large civil marine aircraft which have appeared abroad, notably in America and France, and very recently the first details were released of the big new "Empire" boats for Imperial Airways. Within four years the flying boat will have come into its own in long-distance commercial operation.

Complete specifications of the new Imperial boats are not being publicised. It is known, however, that they are to be cantilever monoplanes with four Bristol engines and flat-sided hulls, that their gross weight will be about 40,000 lb. and that their maximum speed will approach 200 m.p.h. Certain other particulars are to be found in *Flight* of September 26th this year.

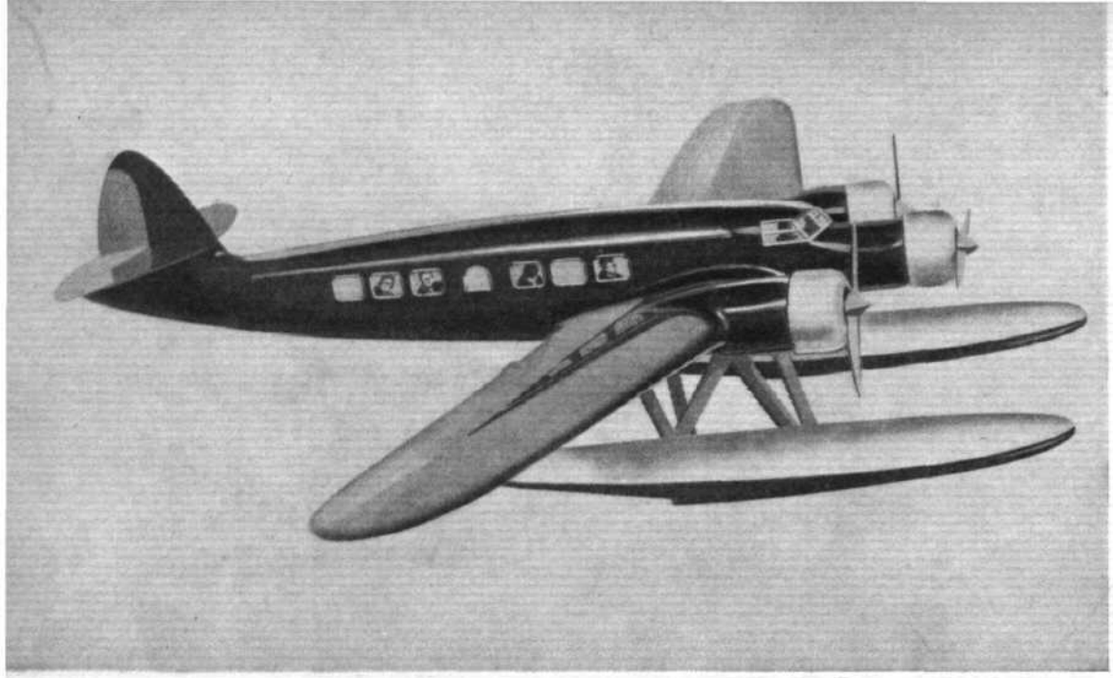
In general layout their design will resemble that of the Martin 130 and Sikorsky S-42 machines of Pan-American Airways, which are, for the time being, probably the most efficient class of their type in the world.

It is apparent, in fact, that large flying boat design has reached a period of temporary stability. The single-hulled four-engined monoplane seems to be the type in demand for operation on the main trunk routes. A study of the commercial marine aircraft being produced by the various nations brings to light, however, very considerable and highly interesting variations in structure and detail design among these machines.

So far as is known, no new large commercial biplane flying boat is under construction anywhere in the world. As in the aeroplane field, the monoplane looks like putting the biplane well in the shade. The Martin and Sikorsky boats have strut-braced monoplane wings, but that of the Short "Empire" machine will be a full cantilever struc-



Styles from the States: In the heading picture is seen the Sikorsky S-42 (four 750 h.p. Pratt and Whitney Hornets), while on the right is the Martin 130 (four 800 h.p. Pratt and Whitney Twin Wasps). Their gross weights respectively are 40,000 lb. and 51,000 lb. and their maximum speeds 190 m.p.h. and over 170 m.p.h.



A multi-engined twin-float seaplane is something of a rarity these days. This is a model of the Italian Cant. Z.506. With three Piaggio Stella X.R. engines it is expected to do about 190 m.p.h.

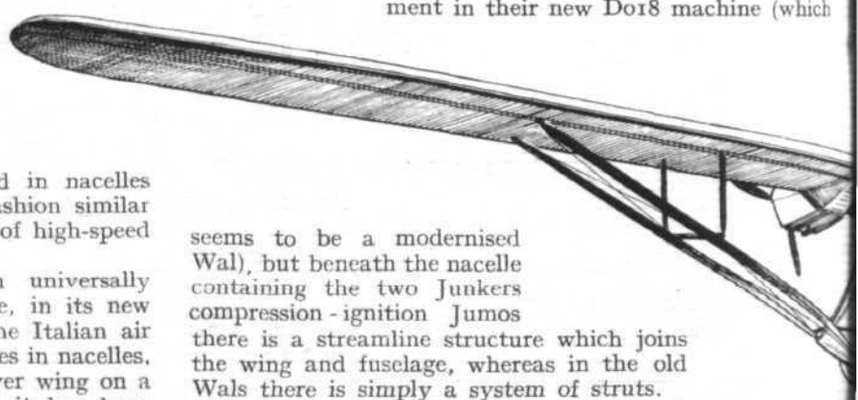
ture tapering, incidentally, in plan form and thickness. One feature common to both the American designs is the superstructure above the hull proper, on which the wing is mounted. On the Sikorsky this is comparatively small, and extends roughly for the chord of the wing. The Martin designers, however, have continued this auxiliary structure, in the case of their 130 Clipper, well forward of the leading edge of the wing and have merged into it the pilots' cabin. The Sikorsky's cabin is completely within the main portion of the hull. In the big Latécoère 521 *Lieutenant de Vaisseau Paris* the superstructure has been still further accentuated and actually forms a second deck.

The purpose of such a structure is to raise the wing well above the waterline, thus permitting the engines to be installed in nacelles projecting from the leading edge after a fashion similar to that adopted for the better-known types of high-speed aeroplane transports.

This practice, however, has not been universally adopted. The Macchi concern, for instance, in its new twin-engined amphibian for Ala Littoria, the Italian air operating company, has placed the two engines in nacelles, which are in turn carried above the cantilever wing on a system of struts. In this case, of course, it has been possible to attach the wing directly to the hull. For some years past this arrangement has been popular on some of the smaller types of flying boat monoplanes, notably the Saro range and the Douglas Dolphin. It has also been extensively used on the twin-hulled Savoia Marchettis, among other types.

One disadvantage is the drag of the structure supporting the nacelles. In America the Fairchild Company, which is building a series of "Baby Clipper" amphibians, with one Hornet engine each, for Pan-American Airways, has designed an exceptionally clean mounting which takes the form of a welded steel tube structure attached at one point to the rear spar and at two points to the front spar, the whole being carefully faired in. Another interesting installation over a monoplane wing is to be found on the Lioré et Olivier H-242 boats operating on Air France's trans-Mediterranean service. Their four Gnome-Rhone K.7 radials are mounted in two nacelles, two acting as tractors and two driving propellers.

Dorniers, with their evergreen Wal, compromised between the two types of installation, attaching the engine nacelle, or nacelles in the case of the Super Wal, directly to the wing. They have retained this arrangement in their new Do18 machine (which seems to be a modernised Wal), but beneath the nacelle containing the two Junkers compression-ignition Jumos there is a streamline structure which joins the wing and fuselage, whereas in the old Wals there is simply a system of struts.



Flying boats, being among the largest types of aircraft built, are bound to display something of interest in the matter of wing structure. The main wing spar in the new Short boats will be a rectangular box with corners of extruded sections and a covering of light alloy, the leading and trailing edges being attached. On the Martin the 130ft. wing, which has an area of 2,170 sq. ft. and which has a slight negative dihedral angle on the inboard sections, embodies stressed skin, with corrugated sheeting covered with smooth metal, flush riveted over the entire leading edge. That of the S.42 is made in one piece, and is of the two-spar stressed-skin type. The wing of the Latécoère 521 has its centre section anchored to the top of the upper hull structure, and is composed of two box spars which, together with the ribs and the interior bracing, are of duralumin. Duralumin sheet is used to cover the centre section, but the outboard panels are fabric-covered.

Hull layout is one of the major trials of a designer of commercial flying boats, for spaciousness must be linked with good aerodynamic form and seaworthiness. The Short Company, famed in the past for its beautiful "waisted" hulls which, measured over the chine, were of very wide beam, but which above that portion were of comparative small cross section, is not adopting this type of hull for the "Empire" machines. Instead, these boats will have flat and vertical sides, and in front elevation are likely to appear narrow (although actually the hull will be extremely roomy), and may resemble in this respect the Rohrbach Romar and Rostra machines of a few years back. The hull depth provides room for two "decks."

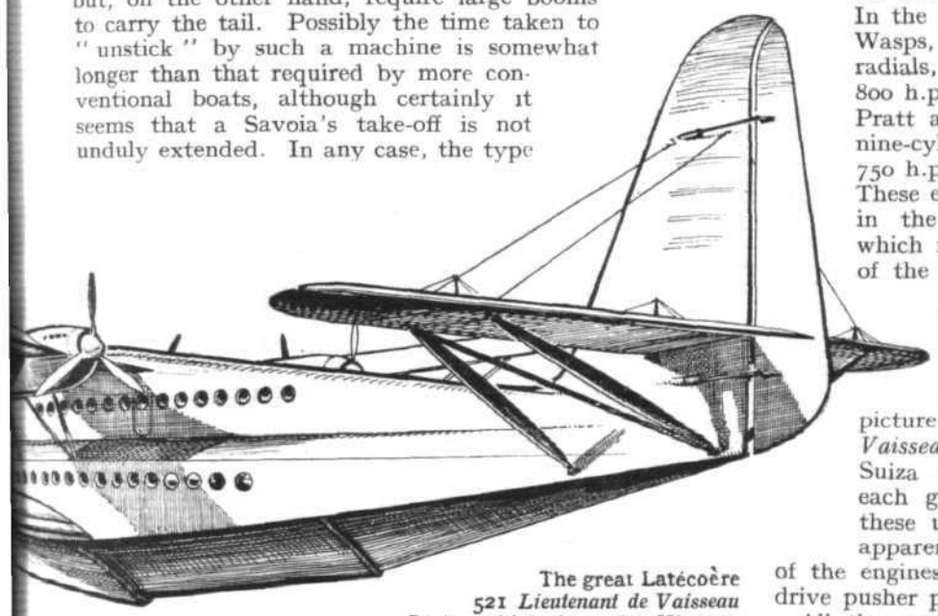
The Sikorsky S.42 has a hull with somewhat similar characteristics, although, as already explained, this is not

"Seawings" is the name given to the stabilising members of the Martin. Aerodynamically they give 50 per cent of the lift of that of an aerofoil of corresponding area.

attached directly to the wing, and consequently is not so proportionately tall as that of the Short boat. Vertical side plating—perfectly flat from chines to gunwales—is employed. There is a deep girder-type keel to which the built-up bulkheads and transverse frames are attached. The Vee bottom has two steps, that portion just ahead of the aft step being given a decided "throw-down."

Corrugated alloy sheet has been used in the bottom and deck of the Martin's hull. This, it is claimed, is very effective, permits a radical simplification of the internal structure, with a consequent saving in weight, and has a high resistance against local punching impacts. The hull of the Latécoère 521 has a heavy keel, is equipped with two steps and is divided into seven watertight compartments, all the longitudinal and cross-members being of open section and easily inspected.

Whether or not the Savoia Marchetti Company will retain in its future flying boats the twin hulls which have characterised its products for several years past remains to be seen. Twin hulls, of course, obviate wing-tip floats and sponsons for lateral stability on the water, but, on the other hand, require large booms to carry the tail. Possibly the time taken to "unstick" by such a machine is somewhat longer than that required by more conventional boats, although certainly it seems that a Savoia's take-off is not unduly extended. In any case, the type has proved highly popular for civil and military service.

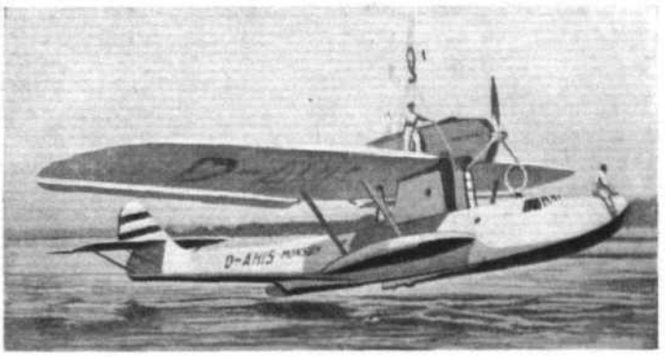


The great Latécoère 521 *Lieutenant de Vaisseau Paris*, which has six Hispano Suiza Y-class engines giving 880 h.p. apiece. It is said to have reached 158 m.p.h.

The Savoia system of hull construction, incidentally, is of exceptional interest. Ash, spruce and plywood are used for the main structure, the covering, above the water line, being of plywood. Below the water line the skin is doubled, and doped fabric inserted between the two skins.

For the time being, air-cooled radials are being favoured for installation in commercial aircraft, and the large flying boat is no exception. Of all machines, this type is perhaps the one to which the diesel engine is best suited, but as this type of power plant is at present rather in disfavour owing to its relatively poor power/weight ratio and low take-off power, it has been adopted only in isolated instances.

The new Dornier catapult boats for the South Atlantic service are having two Junkers Jumos—six-cylinder (two



Two Junkers Jumo compression-ignition engines are fitted to this new Dornier Do18, which is intended for the South Atlantic service.

pistons per cylinder) opposed water-cooled C.I. engines—which allow a range of well over 2,000 miles.

Pratt and Whitney engines are being specified for Pan American's Martin and Sikorsky boats. In the former case the units are four S1AG Twin Wasps, which are fourteen-cylinder two-row radials, geared 3:2 and supercharged to give 800 h.p. at 7,000ft. The Sikorsky uses single-row Pratt and Whitneys—"E" type Hornets of the nine-cylinder radial type, geared and developing 750 h.p. at 7,000ft. or 2,500ft., according to type. These engines, incidentally, are also being installed in the Sikorsky S-43 twin-engined amphibian, which may be regarded as a scaled-down version of the four-engined type.

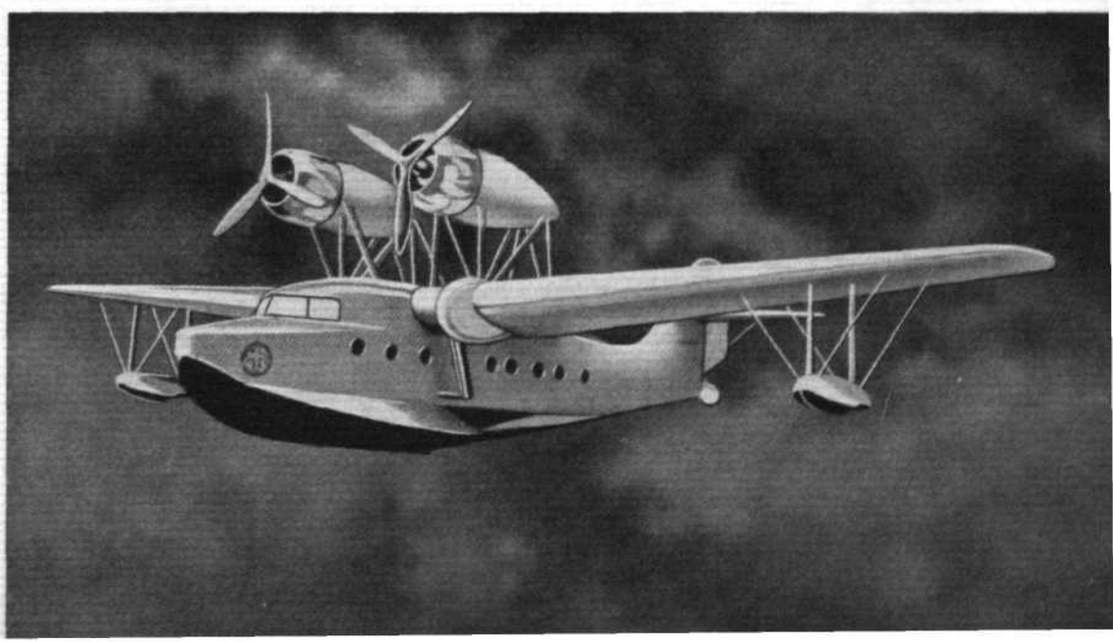
Ala Littoria's new Macchi amphibian has been designed to take either the Italian Piaggio Stella X or the geared Cyclone F.52.

The water-cooled, or, rather, liquid-cooled, engine is not entirely out of the picture. Installed in the Latécoère *Lieutenant de Vaisseau Paris* are no fewer than six Hispano Suiza 12 Ydrs1 twelve-cylinder vee-type units, each giving 880 h.p. at 7,870ft. For take-off these units give 918 h.p. They are geared, but apparently C.P. airscrews are not fitted. Four of the engines act as tractors, while the remaining two drive pusher propellers.

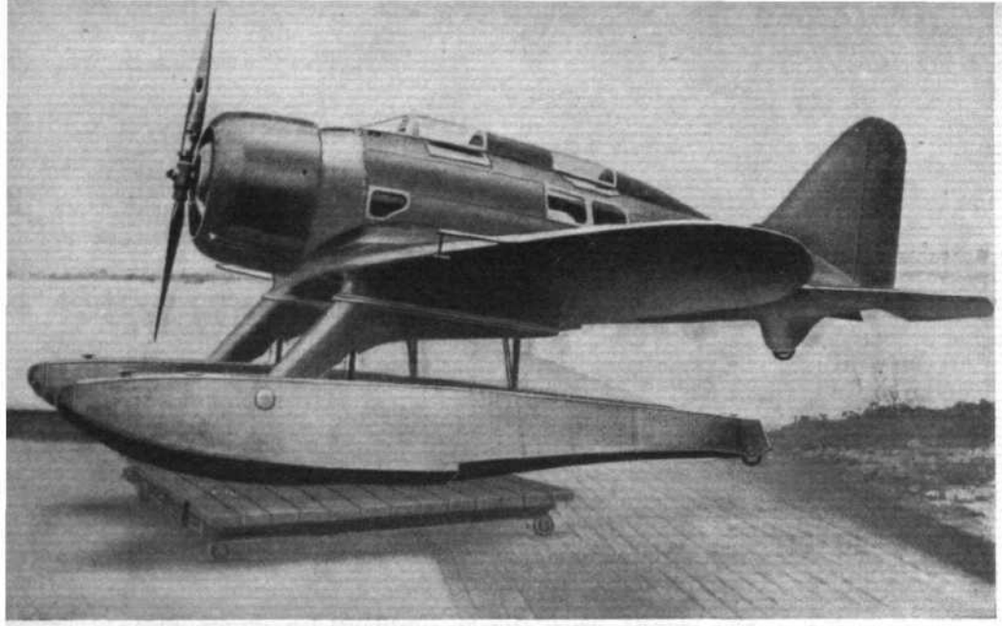
All the engines referred to so far, it may have been noticed, have been only of the moderately supercharged type. This class of engine, of course, permits very high power for take-off and cruising at comparatively low altitudes. There is a distinct possibility that in the not far distant future the fully supercharged engine will be adopted.

Variable-pitch airscrews are consequent on the high wing-loading now being adopted for large flying boats. Flaps, too, are being included in the great majority of new designs, although, surprisingly enough, no form of flap or air brake is incorporated in Pan American's Martin.

One matter on which the world's flying-boat designers differ considerably is that of stabilising their machines on



The wheels of the Italian Macchi C-94 twin-engined amphibian for Ala Littoria are carried, when raised, forward of the leading edge of the wing.



The Seversky amphibian was designed expressly for its job. Its wheels are housed in the floats when retracted.

the water. There are three main methods by which this end may be achieved—auxiliary floats beneath the wings, twin hulls, and stub wings, or " sponsons," projecting from the hull. The former is the method generally favoured in this country, and wing-tip floats will be used with the new Empire boats. These floats, if suitably attached to the wing, can be made to offer remarkably little resistance, but exponents of the remaining methods of water stabilisation maintain that they are easily wrenched off by a landing on a rough sea.

The latest American Consolidated naval flying boat has wing-tip floats which are actually arranged to retract outward and upward and to form, in their raised position, the tips of the wing. This machine is not the only recent American type with retractable floats, for those of the Fairchild " Baby Clipper " for Pan American Airways fold up against the underside of the cantilever wing, being attached to a parallelogram arrangement of struts.

On the new Sikorsky boats the wing-tip floats, which are of similar general construction to that of the hull, are attached with two struts and are wire braced. The Martin company, however, has adopted " sea-wings " for its Pan American boat, these serving as sponsons, lifting surfaces and fuel containers. It is said that, aerodynamically, their lifting value is about fifty per cent. of that of a true aerofoil of corresponding area. One other interesting fact came to light during wind-tunnel tests with the Martin. It was found that, so carefully had the relation of the sea-wings to the main airflow been studied, the total drag was greater without them than when they were present.

Comfort

Accommodation for passengers must be the subject of extremely thorough study in the design of flying boats for long-distance operation.

In the hull of the Short Empire type of boat the forward portion will be divided into two decks. On the upper will be the crew's quarters and holds for mail and cargo; the lower deck will be devoted entirely to passengers. Sleeping berths will be included for the night flying which these craft are to undertake as part of their normal duties.

The Martin 130, which has a maximum seating capacity of forty-six for comparatively short-distance operation, is arranged as follows: Leading forward from the rear of the hull is a companion-way to the rear deck, a lavatory, two passenger compartments, a lounge, a third passenger compartment, a baggage room with space for a galley, and a mail compartment. Above the level of the hull proper (that is to say, in the superstructure previously referred to) are working quarters for the pilot, co-pilot, radio operator, and mechanic.

In multi-engined machines the equipment in the pilots' cockpit has become so complex that superhuman concentration is required to give it the requisite attention. Accordingly, a mechanic is carried in the Martin in a separate control room just below the wing. To him has been assigned all the engine instruments and controls save the tachometer, throttle, and boost gauge for each engine, which are retained by the pilots.

Four separate compartments, each seating eight passengers, are provided in the hull of the Sikorsky S-42; these, like all the other compartments, are separated by watertight doors. There are two lavatories, a smoking room, and a baggage compartment, the last named being located between the pilots' cockpit and the smoking room. Inflatable rafts are stowed in racks in the baggage compartment and behind the main entrance, on the port side of which is a mail compartment. The extreme stern of the hull is available for mail and baggage. No piping or other equipment containing petrol enters the hull; all fuel and oil is carried in the wing.

In the bows of the Latécoère 521 is a hold for the marine equipment, as is general with these large boats. Aft of this are three compartments for ten first-class passengers, six de-luxe cabins each containing two beds, a wardrobe and a private bathroom. A bar and a kitchen, together with the second-class cabin, are arranged in the after hull. The pilots' compartment is directly aft of the captain's room, and behind it is the wireless cabin and the mechanic's quarters. A gangway gives access to the engine nacelles, and the rest of the space, toward the stern, is devoted to a cabin for forty-two second-class passengers.

In certain parts of the world the amphibian type is in demand, and lately some extremely interesting machines in this class—some of them of unusually large dimensions for amphibians—have been developed.

Pan-American Airways has adopted the single-engined Fairchild, certain features of which have already been discussed. The land undercarriage of this 184 m.p.h. eight-passenger monoplane folds rearward and upward so that, when retracted, the wheels lie flush with the wing.

A larger type, the twin-Hornet-engined Sikorsky S-43 amphibian, has a retractable landing gear, which, incidentally, weighs complete 1,000 lb. When retracted, the wheels are recessed into the hull until only half exposed, since wind-tunnel tests showed that complete " burying " gave no measurable increase in performance.

Ala Littoria's new Macchi has its wheels arranged to retract, partly into fairings and partly into the leading edge of the wing.

The large twin-float seaplane is not, apparently, entirely dead, for the Italian Cantieri Riuniti Dell'Adriatico has designed the Cant. Z.506. This is a large three-engined low-wing cantilever monoplane for twelve passengers, and will be fitted with three Fiat or Piaggio radials of 700 h.p. each. The floats are mounted entirely independently, roughly beneath each outboard engine nacelle. A maximum speed of 186 m.p.h. is expected. Bellancas have designed a twin-float seaplane version of their twin-engined high-wing machine, and are providing also for amphibian gear.

Smaller seaplanes and amphibians are, of course, in demand. Often these are merely developments of existing aeroplane types, but in certain cases are designed expressly for their job, as is the case with the Seversky types. It seems that when a typical high-speed, single-engined commercial monoplane of the type popularised in America is put on floats its performance is bound to suffer badly. One of these machines which, with retractable land undercarriage, did 195 m.p.h., had its speed reduced by 35 m.p.h. when converted into a seaplane.

The following figures are interesting in that they demonstrate the efficiency of three of the latest and largest commercial flying boats in the world :—

	Sikorsky S-42 A	Martin 130	Latécoère 152
Gross Weight (lb.) ...	40,000	51,000	69,519
Maximum Speed (m.p.h.)	190	over 170	156
Total Horse Power ...	3,070	3,200	5,280

RECORDS in SEASON

A Gipsy Six Trio : Gull Beats Australia Solo Time : Success of the Heck : Miss Jean Batten (Gull) Off to Brazil

IT never rains but it pours, we are told, and certainly this adage seems to hold good in the matter of record flight attempts. Unhappily, the highly meritorious performances of Broadbent, Llewellyn and Melrose were put up during a week in which one of the greatest long-distance pilots of them all disappeared on his last great attempt, as related elsewhere.

H. F. Broadbent broke the England-Australia solo record of 7 days 4 hr. 50 min., previously held by Sir Charles Kingsford Smith. He left Croydon last Saturday week, and his time was 6 days 21 hr. 19 min. Both flights were made in Percival Gulls, but whereas Kingsford Smith's machine had the 130 h.p. Gipsy Major, that of Broadbent (which, incidentally, he was delivering to an Australian customer) was powered with the 200 h.p. Gipsy Six.

On landing at Port Darwin, Broadbent said that the worst section of his flight was that between Rangoon and Singapore, on which he met gales and rain.

The day after he reached Port Darwin, having then broken the record, he pushed on across Australia to Sydney, which he reached in 18 hours.

No confirmation has been received at the time of going to press regarding the equipment of the Gull, but, whatever it was, it seems to have behaved itself admirably.

C. J. Melrose, who left Croydon simultaneously with Broadbent in a Gipsy-Major-engined Gull (the machine he flew in the King's Cup race this year), abandoned his record attempt at Singapore on Friday to join the Singapore IIIs and Vildebeests of the R.A.F. in their search for Kingsford Smith. He said on landing that while crossing the Bay of Bengal at two in the morning he saw exhaust flames in the darkness above him and concluded that they were from the Wasp of "Smithy's" Lockheed.

Meanwhile Mr. David Llewellyn, the Hanworth instructor, and Mrs. Jill Wyndham were hurrying back from Capetown in their Parnall Heck, attempting to lower Mrs. Mollison's figure for the trip. They effected a reduction of 18 hr. 48 min.

It may be recalled that they had intended also to lower the record for the outward trip. Apparently they were going strongly, but their chances were ruined by a forced landing in an African rice field. The Heck was set down by the light of lamps carried by an Arab funeral procession.

Mr. David Llewellyn, Mrs. Jill Wyndham and the Parnall Heck (200 h.p. Gipsy Six engine) in which they have just beaten the time for the Cape-England journey. It made the trip in 6 days 12 hr. 17 min.

On the way back everything went comparatively smoothly as far as Marseilles (except over the 10,000ft. Abercorn Scarpment in South Africa, when only his sun helmet saved Mr. Llewellyn from stunning himself against the cabin roof during a bump which turned the Heck nearly upside down), but thick clouds down to the ground in the Rhône valley compelled them to return there. Next morning after leaving, contrary to the advice of officials, they were forced to make a detour of hundreds of miles, actually penetrating well into Spain, to fly round the "soup."

The Heck (of the type for which Aircraft Exchange and Mart are the concessionaires) was powered with a Gipsy Six engine. According to a wire received from Mr. Llewellyn the Lodge plugs were unchanged throughout the 16,000-mile trip. Other items of equipment were: Fairey metal airscrew, B.T.H. magneto, Smiths instruments, Husun compass, Sperry directional Gyro, Rotax starter, Palmer tyres and brakes, and Cellon dope.

At 6.30 on Monday morning Miss Jean Batten left Lympne on the start of a flight to South America, hoping to beat the record for the South Atlantic crossing from West Africa to Port Natal, Brazil. She reached Casablanca at 4.15 p.m., and intended to leave for Dakar, the take-off point for her sea crossing, on Tuesday. Miss Batten's mount is another Percival Gull mounting the Gipsy Six, in which Miss Batten has unshakable faith, for she is carrying no parachute, lifebelt or collapsible boat.

Mr. H. F. Broadbent, who now holds the record for a solo flight from England to Australia. His machine was a Percival Gull with a Gipsy Six engine, and his time 6 days 21 hr. 19 min.

The Sikorsky in England

IT is reported that Aircraft Industries Corporation, Ltd., have acquired a site of 120 acres at Hamble, fronting on Southampton Water, for the construction of Sikorsky S. 42 flying boats.

A new company known as British Marine Aircraft, Ltd., will be launched with a capital of £450,000.

PREVENTING ICE FORMATION

The Thermal, Mechanical and Chemical Methods of Combating the Danger : A Résumé of the Paper Read by Mr. B. Lockspeiser before the R.Ae.S.

NO one can deny that the formation of ice on aeroplanes constitutes a very real danger now that blind and general bad-weather flying is the order of the day. On November 4th Mr. B. Lockspeiser, M.A., in a paper read before the Royal Aeronautical Society, described the work done at Farnborough and the system which has been developed there for the prevention of accretion. This system has, incidentally, now been taken up by the Dunlop Rubber Company, and was described in *Flight* of July 4th.

Mr. Lockspeiser, before proceeding to deal with methods of prevention, dealt briefly with the meteorological conditions under which rapid ice formation was possible. These conditions were, incidentally, enlarged upon in an article in *Flight* of February 21 this year. From the mass of evidence collected in recent years, he said, as to the particular meteorological conditions and the associated ice deposits, the following broad conclusions might be summarised:—

(1) In the main ice formed only at leading edges whence it built forward and outwards. At times the whole wing surface might become covered with a light frost or glassy ice film and icicles might appear at the trailing edge.

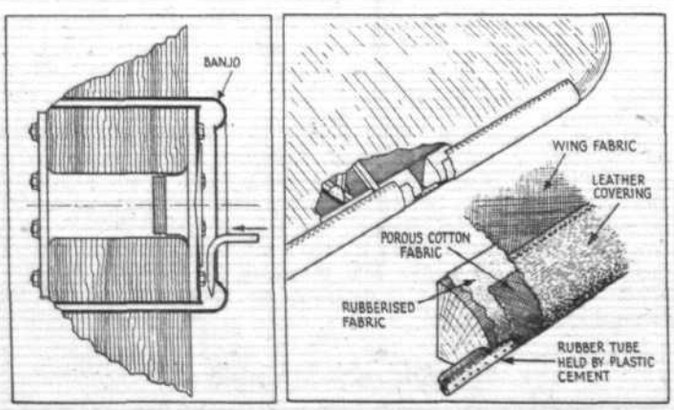
(2) Ice dangerous to aircraft formed only when visible moisture was encountered in the form of rain, mist, cloud or fog.

(3) The heaviest rate of accretion of ice was due to rain falling from a warmer stratum of air on an aeroplane flying in a colder region whose temperature was below freezing point. The air temperature at the height of flight was usually, under these conditions, not more than two or three degrees below 0°C. Clear ice, hard and glassy, was invariably formed under these conditions.

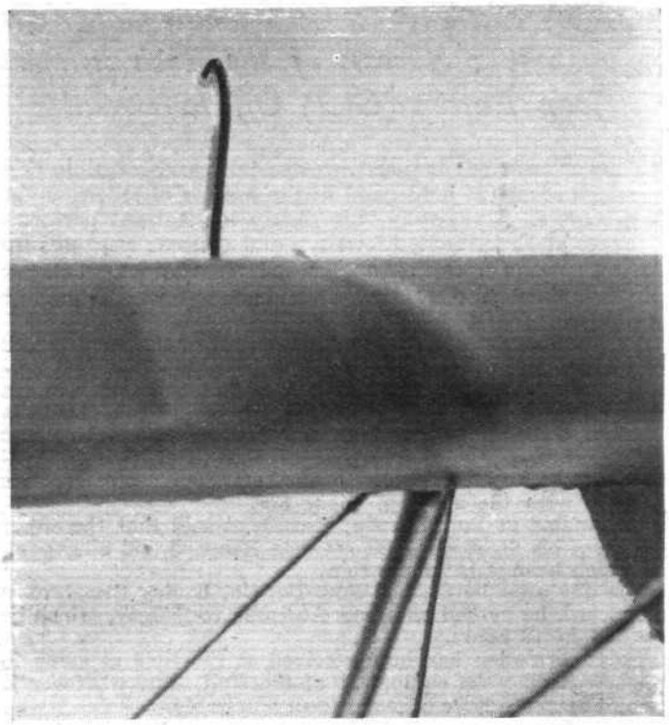
(4) Super-cooled droplets of water might exist in mist, cloud or fog down to −20°C. On contact with leading edges instantaneous freezing took place. Because the moisture content of air masses decreased with lowering of temperature, air temperatures just below the freezing point were most conductive to rapid ice accretion. Ice formed under these conditions was usually white and opaque, granular in structure. Clear ice might also be deposited under these conditions.

(5) Both clear and opaque ice adhered strongly to the surfaces on which they were deposited in flight. The adhesion of clear ice was, in general, greater than that of the opaque variety.

(6) The deposition of clear ice often gave rise to irregular flattish shapes of increased frontal area at the leading edge.



The sketch on the left shows the method suggested by Mr. Lockspeiser for leading the anti-freezing mixture from the airscrew hub. On the right the Anticer is shown in diagrammatic form. The device is now being marketed by the Dunlop Company.



This remarkable picture was secured by *Flight's* chief photographer, who went "ice-hunting" in a Hawker Hart piloted by Flt. Lt. Bulman. It shows ice that has formed on the fuel tank vent pipe. Another photograph appears on page 511.

(7) White opaque ice tended usually to build forward into crescent shapes, less dangerous immediately than the shapes associated with clear ice, but sufficiently so to impair performance and lead to forced landings eventually.

(8) The temperature range favourable to the most rapid formation of either clear or opaque ice was within a few degrees below 0°C.

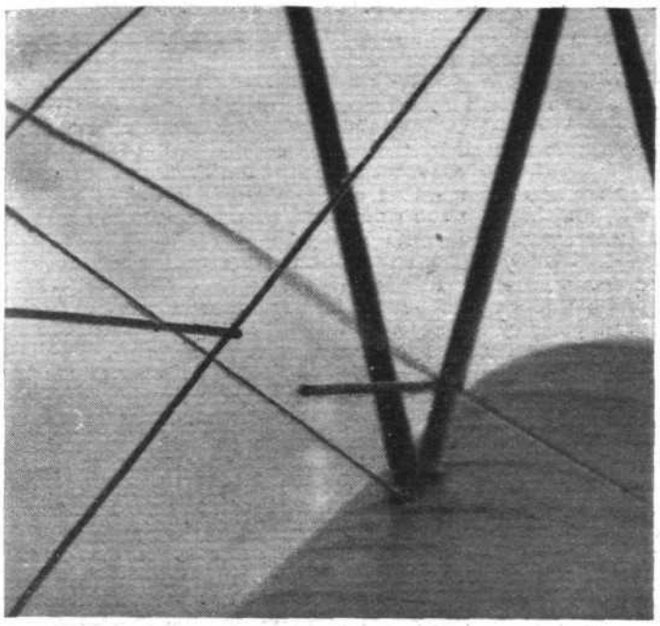
The three possible methods whereby the accretion of ice on aeroplanes might be prevented were thermal, mechanical and chemical.

Although the ice deposit was normally confined to leading edges, it was found that if the nose of a wing alone was maintained about 0°C. the water was blown back and freezed in ridges parallel to the chord. Theodorsen and Clay, who had made a full-scale investigation of this method, provided a slot, running along the span in the neighbourhood of maximum wing thickness, to catch the water and means for draining the slot in flight. There were obvious aerodynamic objections to such a course, and there was little doubt that the successful application of the thermal method of preventing ice accretion involved the provision of heat for raising the temperature of the entire wing.

Thermal Methods

How much heat, he asked, would be required for this purpose? The amount, of course, depended on wing section and air speed. From wind tunnel tests on a R.A.F. 48 section, M. Scott estimated that a monoplane of 40ft. span, with an average chord 6.7ft., at an air speed of 180 m.p.h., required 144 h.p. to maintain the wing 20°C. higher than the surrounding air. This figure was comparable with those deduced from other experimental work. It was clear that the heat was such that we must look either to the jacket or to the exhaust heat for the source of supply.

The evidence also pointed to the use of a direct rather than an indirect use of these sources. From time to time schemes had been forward for leading warmed air from muffs round the exhaust pipe to the interior of the wing. The fundamental difficulty here was that the necessary rates of heat transfer, in all stages, from the exhaust gases to the wing, could only be obtained by the piping of large surface areas involving weight considerations and constructional difficulties such as to render these schemes entirely impracticable. The thermal method was



The ice-collecting expedition was continued until the steadying tube between two of the wires fractured, due to vibration caused by the heavy accretion on the wires. It should be pointed out, incidentally, that this was not on the Hart mentioned by Mr. Lockspeiser in his lecture. (*Flight* photograph.)

unsuitable for application to existing aircraft and must be considered in relation to the thick section all-metal monoplane of the future.

The direct method of using the jacket or the exhaust heat involved, in the one case, wing surface radiators and, in the other, the discharge of the exhaust through orifices along the span from a pipe integral with the leading edge. As regards wing surface radiators, it would be desirable to use them in conjunction with evaporative engine cooling, for the tendency of vapour to condense at the coolest places promoted uniformity of wing heating. Part of the vapour in the system could be by-passed to dissipate its heat in the tail unit. Apart from preventing ice accretion, wing surface radiators carried with them the advantage of eliminating the parasitic drag of the normal radiator. This method of using the jacket heat for preventing ice accretion appeared attractive, but the attendant plumbing difficulties could not be lightly disregarded and, from a military point of view, an aeroplane carrying such a system might be more vulnerable.

Exhaust Heating Dangers

The discharge of the exhaust gases at wing leading edges was by no means simple. There was the danger of corrosion allowing the hot gases to play on the wing structure, the proximity of the petrol tanks in the thick metal wings, the possibility of an explosive charge entering the wing nose and the necessity for allowing free movement of the nose to allow for differential thermal expansion. These were formidable difficulties though not, perhaps, insuperable. On the other hand, there were the advantages of reduction of exhaust noise, the elimination of the parasitic drag of external exhaust pipes, and, as Mr. F. W. Meredith, of the Royal Aircraft Establishment, suggested, an appreciable net drag reduction was to be expected from discharging the hot gases at the front stagnation region of the main surface.

Much remained to be done before heat normally running to waste could be harnessed for the prevention of ice accretion, but, because the utilisation of this heat carried other advantages which assumed greater importance as design became cleaner, it was not improbable that designers of the future might solve the ice problem on these lines.

A mechanical method of dislodging ice involved a pulsating movement which was induced in rubber overshoes fitted over the leading edge. The regular pulsation of the overshoe by compressed air enabled the ice to be broken up and blown away. Such a method had been used in America. As regards the airscrew, rubber sheeting was firmly atached to the spinner and to the blades on their thrust side, around the leading edge and back on the convex side to approximately the line of thickest section. The rubber in this case was impregnated with an oil mixture before flight.

There was one certain way of reducing the adhesion of ice to a small value— by ensuring that the super-cooled water mixed at the surface of contact with a substance which depressed the freezing point of water sufficiently to maintain a liquid boundary layer. For this purpose liquids miscible in water in all proportions were very much superior to water soluble solids, on account of the more rapid rate of mixing of the former. A large proportion of the early work devoted to the problem of ice prevention was directed towards finding a hard, water soluble coating of this nature, which could be painted on the leading edges before flight, and some success was obtained both in tests in the refrigerated wind tunnel and in flight.

The application of anti-ice dopes to leading edges was, however, hardly a practical solution of the problem, but the experience gained from flight tests demonstrated that it was not necessary to provide an anti-freezing substance in sufficient quantity to melt all the ice. It was only necessary to maintain a liquid boundary layer at the surface of contact.

The obvious requirement to transform this principle to a successful practical method was a porous leading edge which could be saturated, at the will of the pilot, with a liquid possessing a strong effect in depressing the freezing point of water, and through which the liquid could be made to flow uniformly at a variable rate. The quantity of liquid required, if discharged economically (all forms of spraying must be avoided), was not excessive, for the worst conditions occurred only two or three degrees below 0 deg. C. and the concentration of anti-freezing liquid in the boundary layer necessary to maintain this small depression of the freezing point of water was low.

Any practical method of achieving a porous wing nose must provide for a hard wearing serviceable substance which, in both the dry and wet state, kept its shape. Moreover, fitting as a whole must not impair appreciably the aerodynamic characteristics of the wing. To meet these requirements specially tanned leather was selected as the outer porous covering to which liquid was fed continuously from the inside through a perforated rubber tube.

The Anticer Described

In the system developed a layer of rubbered fabric was doped to the wing with the rubbered surface uppermost. The liquid was conveyed by a rubber tube punctured at ¼in. intervals along its length. The tube was made to adhere to the leading edge partly by rubber solution and partly by a plastic cement or rubber sponge, which served also to fair off the edge. A porous cotton fabric layer spread the liquid to wet the leather covering. Attached to the leather were strips of aeroplane fabric, which, when doped to the wing, held the leather covering firmly in place. The change in shape of the wing section due to the fitting was small enough to be negligible. The liquid was supplied to the perforated rubber tubing under pressure by means of light piping to the parts of the aeroplane requiring protection. Since the flow of liquid was small the system was effectively under hydrostatic pressure and the flow at all parts was approximately uniform.

The liquid container might be connected through a reducing valve to an existing pressure supply (such as a compressed air bottle for operating brakes or an oxygen bottle) without depleting the supply appreciably. If no convenient source of pressure was available, either a bottle partially filled with the liquid under pressure or a small pump might be used. In all cases the flow, indicated on a simple flow meter of the moving vane type, was under the control of the pilot.

A suitable liquid should satisfy the following requirements:— (a) Low setting point; (b) Miscible in all proportions with water; (c) Large effect in depressing the freezing point of water; (d) Low vapour pressure below 0 deg. C.; (e) High flash point.

Ethylene glycol was a suitable liquid. Its flash point was 125 deg. C. and vapour pressure was 0.02 mm. of mercury at 0 deg. C. Its setting point (— 18 deg. C.) was, however, too high for use at the lowest temperatures of ice formation. This might be reduced by mixture with other liquids. Ethyl alcohol (10 per cent. by volume) lowered the setting point to — 24 deg. C., but the flash point was lowered also to 60 deg. C.; 10 per cent. butyl carbitol lowered the setting point to below — 30 deg. C., the flash point remaining as high as 118 deg. C. The depression of the freezing point of water was increased somewhat by the addition of 10 per cent. of ethyl alcohol, but 10 per cent. butyl carbitol made very little difference. Both ethylene glycol itself and a 10 per cent. ethyl alcohol mixture with glycol had been used with success in flight.

The anticer has been tested under ice forming conditions on both Hart and Gordon aeroplanes. On one occasion when

Preventing Ice Formation.—

a thickness of 1in. of ice was built up on the struts of the Hart aircraft an observer who kept the tail unit under close observation reported :—"After being at −2 deg. C. for some minutes ice was noticed forming on various parts of the aircraft, e.g., bracing wires and struts. It then began to form on the tail unit, first on the unprotected parts. After some time it was noticed that patches of ice were forming on the protected edges, starting with that on the fin. These patches appeared suddenly and, having appeared, did not grow at an appreciable rate. Roughly 10 sq. in. of surface of the fin were covered and about 6 sq. in. of the starboard side of the tail plain. In no case was any ice seen on the port side of the tail plane. After persisting for a few minutes the ice patches suddenly disappeared from the protected parts. These would then be free for a considerable time. Actually, during the one hour duration of the flight ice formed on three occasions only. In every case the ice was more persistent on the fin than on the tail plane. No ice formed on the half of the protected parts nearest the fuselage of the aircraft.

"Meanwhile the other parts of the aircraft were accumulating ice, with the result that by the conclusion of the flight about one inch had been collected on bracing wires, etc. In particular large accumulations occurred on corners, such as the corners of the fin and balanced portion of the rudder and also on the horn of the elevator." The consumption of ethylene glycol for the whole aeroplane was 1.5 pints per hour.

On another occasion a second observer reported similar behaviour of the anticers. Either (a) ice was thawed as quickly as it formed, or (b) ice adhered in places and after a few minutes its adhesion was destroyed and blown away. The rate of flow of the ethylene glycol appeared to determine which phenomenon was observed.

A test flight under heavy ice-forming conditions was also made with a Gordon aeroplane fitted with anticers on the leading edges of wings, tail planes and fin. The liquid was turned full on for some minutes, sufficient to saturate the leather, before entering ice-forming conditions and then turned off. Flight was maintained under these conditions for thirty minutes when the liquid was turned on and flight continued for a further thirty minutes. Ice built up on the struts to a depth of 2½-3½in. Mr. Lockspeiser then read the pilot's report, which explained that the ice accretion on the protected parts was comparatively small and that, five minutes after turning on the anti-freezing mixture, the larger accumulations had broken away. After thirty minutes only isolated crystals remained. Meanwhile, ice continued to form on the unprotected parts.

The nose fitting in this equipment weighed 0.12lb. per foot run for a R.A.F. 26 section. For the Hart aeroplane this amounted to about 9lb. One gallon of liquid, allowing two pints for initial saturation and six pints to cover two hours' flying under ice-forming conditions, weighed 12lb. Provision must be made for container, connections and flow meter, say 8lb., giving a total of about 29lb. in all. The container and its liquid need only be carried when there was a likelihood of meeting ice-forming conditions. The fitting was easy to install on existing aircraft and might be carried out without any appreciable effect on the aerodynamic characteristics.

Pilots flying through ice-forming conditions frequently found themselves in danger of being hit by lumps of ice flung off the airscrew. At any particular point on the airscrew the centrifugal force on the ice varied as the cube of the dimensions and the adhesion as the square; consequently, a certain critical thickness of ice must be reached when the adhesion was overcome. Centrifugal force, also, tended to produce a distribution of ice accreting heavily on the boss and at the root.

Heat generated in the blades in overcoming viscuous drag also played a part in determining the distribution of ice. The temperature reached by the blade increased progressively from root to tip, but no exact measurement has been made. Rough measurements showed that at the tip of a Fairey Reed airscrew, rotating at 1,100 r.p.m. and absorbing 500 h.p., a rise of temperature above the airstream of 14 deg. C. was obtained. Midway between the root and the tip the temperature rise was 8 deg. C. In temperature regions, therefore, where ice formation was more severe, ice deposits were confined to the central parts of the airscrew where the loss of thrust due to change of section on icing was less serious.

The chemical method could be applied to the airscrew with modifications. Wet leather was stretched tightly over and moulded to the shape of the boss and the part of the blade requiring protection. After drying in position it was firmly cemented down, except at the leading edge. Ethylene glycol was led in under the leather by a short pipe at the root, distributed outwards by centrifugal force, percolating through the porous leather along the chord by capillary flow.

Mr. Lockspeiser concluded with an appreciation of the work of his colleague, Dr. J. E. Ramsbottom. Throughout the lecture lantern slides were shown of the various features of the equipment and of its effect in ice-forming conditions. Afterwards a most interesting film, taken from the observers' seats of both Gordon and Hart machines, was run through.

THE DISCUSSION.

IN opening the discussion the chairman, Mr. D. R. Pye, Deputy Director of Scientific Research, praised the Anticer, as the Dunlop equipment is known, because it did not affect the wing form and because it was ready for immediate use. He asked, however, whether the leather would retain its qualities during long periods of disuse.

Major R. H. Mayo also had a good word to say for the system, and stressed the great importance of solving the whole problem of ice formation now that transport flying was being carried out in all weathers. In parts of Central Europe, for instance, cases had been known when 2½ to 3 inches of ice formed on the leading edges in less than a minute.

Imperial Airways, he said, were to try the system out in service conditions.

Mr. Woodall then gave a brief description of the Goodrich de-icer, which had been mentioned by Mr. Lockspeiser and which had been in successful use during the past two winters, and followed this description with a film.

Air Comdre. R. H. Verney also asked whether the leather would stand up to service conditions, whether experiments had been carried out with bigger wing spans and whether the flow would be even in such conditions.

Major C. J. Stewart, in an entertaining speech, spoke of the work involved in the development of the system.

Replying, Mr. Lockspeiser explained that the actual liquid used was extremely good for leather and that this, in fact, was never dry. The holes in the supply pipe were so small that the system worked under hydrostatic conditions and that the difference in pressure between one end and the other was only a matter of a couple of pounds.

Forthcoming Events

Club Secretaries and others are invited to send particulars of important fixtures for inclusion in the list.

Nov. 18. R.Ae.S. Lecture: "Cooling Problems with Particular Reference to the Work of the 24-ft. R.A.E. Tunnel," by Dr. G. P. Douglas, 6 p.m. Institution of Electrical Engineers.

Nov. 19. R.Ae.S. Students' Section Lecture: "Tapered-wing Stalling," by P. P. Nazir, 7 p.m. R.Ae.S. Library, Albemarle Street, London, W.1.

Nov. 21 R.Ae.S. (Coventry Section) Lecture: "Carburation and Engine Controls," by Lt. H. Cantrill, 8 p.m., Armstrong Siddeley Canteen.

Nov. 29. Yorkshire Aeroplane Club. Annual Ball, Hotel Majestic, Harrogate.

Dec. 2. R.Ae.S. Lecture: "Undercarriage Design," by G. H. Dowty, 6 p.m., Institution of Electrical Engineers.

Dec. 3. Chelsea Colleges of Automobile and Aeronautical Engineering. Dinner and Dance, Grosvenor House, London.

Dec. 6. Hampshire Aeroplane Club: Tenth Annual Dinner and Dance, South Western Hotel, Southampton.

Dec. 16 R.Ae.S. Lecture: Wireless and its Application to Commercial Aviation," by Capt. J. M. Furnival, 6 p.m. Institution of Electrical Engineers.

Dec. 19 R.Ae.S. (Coventry Section) Lecture: "The Stratosphere," by Capt. J. Lawrence Pritchard, 8 p.m. Armstrong Siddeley Canteen.

Dec. 20. London Aeroplane Club. Annual Ball, Park Lane Hotel, London.

1936.

Jan. 16. R.Ae.S. (Coventry Section) Lecture: "Development in Centrifugally Cast Piston Rings for Modern Aero Engines," by Mr. P. R. Twigger, 8 p.m., Armstrong Siddeley Canteen.

Jan. 22. Royal United Service Institution Lecture: "The Expansion of the Royal Air Force," by Air Marshal Sir C. L. N. Newall, at 3 p.m.

Feb. 20. R.Ae.S. (Coventry Section) Lecture: "Variable-pitch Propellers," by Mr. T. E. Beacham, 8 p.m., Armstrong Siddeley Canteen.

Feb. 28. Bristol and Wessex Aeroplane Club: Annual Aviation Ball.

Mar. 10. Royal United Service Institution Lecture: "The Development of Civil Aviation," by Lt. Col. F. C. Shelmerdine, at 3 p.m.

THE ROYAL AIR FORCE

SERVICE NOTES AND NEWS — AIR MINISTRY ANNOUNCEMENTS

CALSHOT NAVIGATION COURSE

The undermentioned officers, having successfully completed the Specialist Navigation Course at the R.A.F. Station, Calshot, which terminated on September 3, are entitled to the symbol "N":—F/O.s D. I. Coote, T. Q. Horner, W. S. Jenkins, and F. A. Pearce. The undermentioned officer of the Royal Australian Air Force also successfully completed the course: F/O. W. H. Garing.

TRANSFER OF OFFICERS TO THE RESERVE

The undermentioned short service, medium service and non-permanent officers should note that they become due in April and May, 1936, for transfer to the reserve, or (where indicated) for relinquishment of commission, on completing their period of service on the active list:—

GENERAL DUTIES BRANCH

Flight Lieutenant:—Lionel George Martin.

Flying Officers:—Peter Hcare Hamley, Reginald Henry Hobbs, †Leonard Cain Slee, †Eric Alan Springall, Edgar Joseph Ninian Heaven, *William Joseph Hickey, Edgar Bowman Waddy.

DENTAL BRANCH

Flight Lieutenants:—Roy Herbert Marthews, L.D.S., and Joseph Edward Tyrrell, L.D.S.

CHAPLAINS BRANCH

*The Revd. Arthur Reginald Anderson Watson, M.A.

*To relinquish commission, not liable for reserve service.

Statements from the two dental officers indicating whether or not they desire to be considered for an extension of service to five and ten years on the active list respectively, are to be forwarded forthwith.

The general duties branch officers marked † have been selected provisionally for permanent commissions.

CATTERICK AERODROME

Extensive levelling operations are being carried out at Catterick aerodrome and will continue for approximately three months. During this period the aerodrome is unsuitable for night landings. The area involved is 400 yards by 500 yards north-east of the landing circle and is marked during the day.

AIR DEFENCE IN THE NORTH

The War Office have issued the following statement:—

The anti-aircraft defences of London and in the South having recently been increased, his Majesty's Government have had under consideration the question of providing further anti-aircraft defences for the Midlands and the North.

A tentative scheme for the provision of these anti-aircraft units is being worked out by the Army Council. The scheme has by no means reached finality, nor is it likely to do so for some time as the views of all concerned have to be ascertained and discussed.

The present scheme does not envisage the amalgamation of the two Lancashire divisions.

No. 5 FLYING TRAINING SCHOOL

The undermentioned officers and airman pilots have been awarded special assessments as shown hereunder on completion of a course of *ab initio* flying training at No. 5 Flying Training School:—

Special Distinction

P/O. G. A. Walker, A.P/O. K. J. Mellor, L.A/C. Harvey, N. B.

Distinguished Pass

A.P/O.s H. M. Pinfold, W. E. Surplice, R. G. Forshaw, G. B. M. Bell, R. D. G. Wight, and L.A/C. Wells, J. C.

OLD CRANWELLIAN ASSOCIATION—ANNUAL DINNER

The annual dinner of the Old Cranwellian Association will be held at the May Fair Hotel, London, W.1, on Saturday, November 23. Any member of the association who has not received an invitation, and who desires to attend, should communicate with the Secretary, Old Cranwellian Association, Royal Air Force College, Cranwell, Lincs.

R.A.F. BENEVOLENT FUND

The usual meeting of the Grants Committee was held at Iddesleigh House on November 5. Air Comdre. B. C. H. Drew, C.M.G., was in the chair, and the other member of the Committee present was Mrs. L. M. K. Pratt Barlow, O.B.E. The Committee made grants to the amount of £305 19s. 4d. The next meeting was fixed for November 18.

AIR FORCE LIST

The November issue of the *Air Force List* has now been published. It can be purchased (price 2s. 6d.) from H.M. Stationery Office at the following addresses: Adastral House, Kingsway, London, W.C.2; 120, George Street, Edinburgh; 2, York Street, Manchester; 1, St. Andrew's Crescent, Cardiff; 15, Donegall Square, Belfast; or through any bookseller.

COMRADES OF THE R.A.F. ASSOCIATION

The annual dinner of the Comrades of the Royal Air Forces Association is to be held at the Thames House Restaurant, Millbank, S.W.1, on November 30. Marshal of the Royal Air Force Lord Trenchard, G.C.B., G.C.V.O., D.S.O., D.C.L., LL.D., will be in the chair and will be supported by Air Chief Marshal Sir Edward Ellington, Chief of the Air Staff, and other members of the Air Council. Music will be provided by the Royal Air Force Central Band. Dress will be lounge suit (no medals) and the time 7 for 7.30 p.m. Tickets, price 3s. 6d. each, are now available, and applications, with the necessary remittance, should be made to Mr. E. W. Phillips, Assistant Hon. General Secretary, Royal Air Force Station, Hendon, The Hyde, London, N.W.9, not later than November 23, 1935.

ROYAL AIR FORCE GAZETTE

London Gazette, November 5, 1935

General Duties Branch

The following are granted permanent commissions as Pilot Officers with effect from October 1 and with seniority of the dates stated:—J. C. Bevan, G. W. Peel, A. B. Rae, K. B. F. Smith, F. W. Thompson (January 1, 1934); T. F. Barker, B. H. Boon, G. G. Cornwall, D. M. H. Craven, L. D. Dadswell, J. R. A. Embling, A. R. Fane De Salis, N. Fisher, A. Foord-Kelcey, B. J. R. Roberts, T. N. K. Walker (July 1, 1934); W. P. Whitworth (July 2, 1934). (Substituted for the notification in the *Gazette* of October 15.)

G. R. H. Black is granted a short service commission as Pilot Officer on probation with effect from and with seniority of October 24.

The following Flying Officers are promoted to the rank of Flight Lieutenant:—R. G. Wilde (September 14); L. J. Crosbie, P. Haynes (October 11); W. E. Coope (October 24).

Group Capt. V. O. Rees, O.B.E., is transferred from half-pay list Scale A, to half-pay list Scale B (May 13); Wing Cdr. G. W. Williamson, O.B.E., M.C., ceases to be re-employed on the active list (November 1); F/O. F. R. Newell is transferred to the Reserve Class C (October 19). (Substituted for the notification in the *Gazette* of October 15); Flt. Lt. P. E. Berryman is transferred to the Reserve Class A (October 31); Group Capt. V. O. Rees, O.B.E., is placed on the retired list at his own request (July 19).

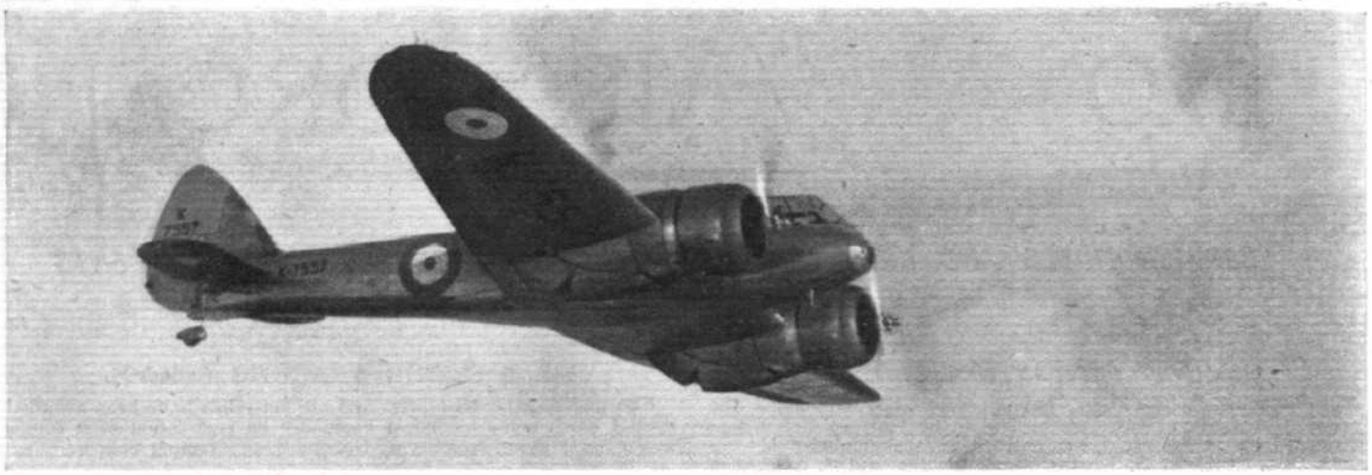
The short service commissions of the following Acting Pilot Officers on probation are terminated on cessation of duty. (November 2):—M. S. C. Hymans, J. M. M. Thompson, T. A. N. Forsyth.

Stores Branch

Sqn. Ldr. A. H. Comfort is placed on the retired list on account of ill-health (November 3).

Medical Branch

R. F. Courtin, M.R.C.S., L.R.C.P., is granted a short service commission as a Flying Officer for three years on the active list with effect from and with seniority of November 1, and is seconded for duty at The Royal Victoria and West Hants Hospital, Bourne-



TOWARDS RE-EQUIPMENT: The Bristol 142 is the prototype upon which the design of the new Bristol medium bombers is based. Other pictures will be found on pages 496 and 507. (*Flight* photograph).

mouth; Flt. Lt. G. M. Anderson, M.B., Ch.B., is promoted to the rank of Squadron Leader (October 28); Flt. Lt. R. K. Muir, M.D., C.M., relinquishes his short service commission on transfer to the Indian Medical Service (October 31).

PRINCESS MARY'S ROYAL AIR FORCE NURSING SERVICE

Staff Nurse Miss A. Lowrey is promoted to the rank of Sister (August 1). (Substituted for the notification in the *Gazette* of August 13); Staff Nurse Miss B. N. Cloke is promoted to the rank of Sister (October 30); Sister Miss K. A. Witts resigns her appointment (November 4); Staff Nurse Miss W. E. Denson resigns her appointment (November 5).

ROYAL AIR FORCE RESERVE

Reserve of Air Force Officers

General Duties Branch

F/O. C. W. W. S. Conway relinquishes his commission on appointment to a commission on the Unattached List for the Indian Army (October 12); the notification in the *Gazette* of July 2 regarding Flt. Lt. C. W. McK. Thompson is cancelled.

SPECIAL RESERVE

General Duties Branch

G. L. M. Malcomson is granted a commission as Pilot Officer on probation (October 5); P/O. C. W. Rees is promoted to the rank of Flying Officer (August 18); F/O. G. R. H. Black relinquishes his commission on appointment to a short service commission in the Royal Air Force (October 24).

AUXILIARY AIR FORCE

General Duties Branch

No. 601 (COUNTY OF LONDON) (FIGHTER) SQUADRON.—C. R. Sarel is granted a commission as Pilot Officer (October 8).

ROYAL AIR FORCE INTELLIGENCE

Appointments.—The following appointments in the Royal Air Force are notified:—

General Duties Branch

Group Captain.—D. Harries, A.F.C., to R.A.F. Station, Amman, Palestine; to command vice Group Capt. F. L. Robinson, D.S.O., M.C., D.F.C., A.D.C., 11.10.35.

Wing Commanders.—R. B. Mansell, O.B.E., to R.A.F. Station, Ramleh, Palestine; to command vice Group Capt. D. Harries, A.F.C., 1.10.35. H. Leedman, O.B.E., to Dept. of A.M.R.D., Air Ministry; on appointment as Assistant Director, Research and Development (Instruments) vice Wing Cdr. G. W. Williamson, O.B.E., M.C. (Retired), 1.11.35.

Squadron Leaders.—W. R. Cox, M.C., A.F.C., to No. 3 Armament Training Camp, Sutton Bridge, for Armament duties, 28.10.35. J. M. Glaisher, D.F.C., to No. 1 Stores Depot, Kidbrooke; for Engineer duties vice Sqn. Ldr. H. P. G. Leigh, 2.11.35.

Flight Lieutenant.—D. B. McGill, to No. 3 Armament Training Camp, Sutton Bridge, 28.10.35. M. L. Heath, to No. 11 Flying Training School, Wittering, 31.10.35. R. Kellett, to No. 32 (F) Squadron, Biggin Hill, 1.11.35. G. H. Russell, D.F.C., to Electrical and Wireless School, Cranwell.

Flying Officers.—J. R. Palmer, to No. 3 Armament Training Camp, Sutton Bridge, 28.10.35. E. Foster, to Armament Training Camp, Leuchars, 28.10.35. P. E. Drew, to Marine Aircraft Experimental Establishment, Felixstowe, 11.11.35. A. J. W. Geddes, to No. 1 Flying Training School, Leuchars, 19.10.35. G. J. Spence, to Home Aircraft Depot, Henlow, 2.11.35.

Pilot Officer.—G. R. H. Black, to No. 101 (B) Squadron, Bicester, on appointment to a short service commission as Pilot Officer on probation, 24.10.35.

Acting Pilot Officers.—A. D. Annand, B. Bell, W. H. Biddell, E. J. Brooks, C. B. Burt-Andrews, J. Butterworth, P. D. D. Carlton, G. C. N. Close, J. L. Crisp, B. E. Dobb, C. E. Drapper, I. A. Fergusson, M. A. L. S. Giles, P. Hadfield, A. Hibberd, G. C. Hyde, M. W. B. Knight, J. H. Magnus, T. F. D. Morgan, G. H. F. Plinston, D. D. Rawlins, P. H. Rebbeck, W. Riley, A. J. Robinson, F. E. Rosier, B. J. Sandeman, J. M. H. Sinclair, H. W. Tennant, J. S. Tupholme, P. R. Walker, J. T. Webster, R. K. Wildey; all to the R.A.F. Depot, Uxbridge, on appointment to short service commissions as Acting Pilot Officers, on probation with effect from 21.10.35. A. S. Ainsley, C. D. Beaumont, J. R. I. Bell, B. G. L. Betbeder, R. Cluer, W. A. L. Davis, J. N. W. Farmer, G. E. Ford, J. H. Greswell, P. J. Halford, J. D. Harris, R. G. Ker-Ramsay, R. N. Lambert, A. W. Lee, G. Lowe, V. E. Marshall, G. F. W. Morrison, W. G. Moseby, M. G. F. Pedley, R. A. G. Petrie, K. Slater, D. C. Smythe, F. G. R. Thomas, G. Thomas, J. G. Towle, J. W. B. Vernon, E. N. Wakelin, G. M. Wyatt; all to No. 5 Flying Training School, Sealand, 19.10.35.

The undermentioned are posted to No. 6 Flying Training School, Netheravon, with effect from 19.10.35:—G. B. Andrews, J. L. Atkinson, J. Barrett, D. R. Biggs, N. M. Boffee, P. T. Bozman, J. B. Burnett, L. R. Field, J. Foulsham, P. A. Gilchrist, H. D. Green, G. F. Hall, P. P. Hanks, P. J. H. Harrington, F. Harrison, P. W. Hartley, G. L. B. Hull, T. M. Hunt, E. G. Jones, C. E. Levitt, R. D. More, B. G. D. Nathan, F. J. Norris, W. M. Penman, C. L. C. Roberts, P. F. Rutter, J. H. Sindall, W. O. L. Smith, P. G. D. Taylor, R. N. Todd-White, D. G. Warren, A. E. Williamson, D. B. M. Wright, and R. P. S. Wyrill.

R. N. Brett, J. H. Carter, N. A. F. Cheesman, J. Compton, P. E. G. G. Connolly, G. I. L. Corder, M. W. Donaldson, G. D. Evers, T. E. J. Fitton, J. W. S. Forbes, H. J. Garlick, A. J. Goldie, A. R. L. Griffiths, N. D. Guthrie, H. A. Hornblow, N. T. Ingham, J. H. Irvin, E. O. Jones, D. Kain, L. S. Lawrence, W. G. Lockhart, H. C. Maudslay, D. I. McLeod, M.C., F. Mee, P. A. B. Neel, J. P. Owens, L. V. E. Petley, A. V. Rogers, J. E. J. Sing, J. P. S. Smyth, F. W. Thomas, A. C. R. Thompson, Y. P. Wilson, A. L. Womersley, all to R.A.F. Depot, Uxbridge, on appointment to short service commissions as Acting Pilot Officers on probation with effect from 21.10.35. E. Rosslyn-Stuart, to R.A.F. Depot, Uxbridge, on appointment to a short service commission as Acting Pilot Officer on probation, 22.10.35.

The undermentioned are posted to No. 11 Flying Training School, Wittering, with effect from 2.11.35:—A. D. Annand, B. Bell, W. H. Biddell, E. J. Brooks, C. B. E. Burt-Andrews, J. Butterworth, P. D. D. Carlton, G. C. N. Close, J. L. Crisp, B. E. Dobb, C. E. Drapper, I. A. Fergusson, M. A. L. S. Giles, P. Hadfield, A. Hibberd, G. C. Hyde, M. W. B. Knight, J. H. Magnus, T. F. D. Morgan, G. H. F. Plinston, D. D. Rawlins, P. H. Rebbeck, W. Riley, A. J. Robinson, F. E. Rosier, B. J. Sandeman, J. M. H. Sinclair, H. W. Tennant, J. S. Tupholme, P. R. Walker, J. T. Webster, R. K. Wildey.

Stores Branch

Wing Commander.—G. Stevens, O.B.E., to Home Aircraft Depot, Henlow; for Stores duties, 1.11.35.

Accountant Branch

Pilot Officers.—C. W. S. Jones, to R.A.F. Station, North Weald, 5.11.35. P. H. Roscoe, to R.A.F. Station, Gosport, 5.11.35.

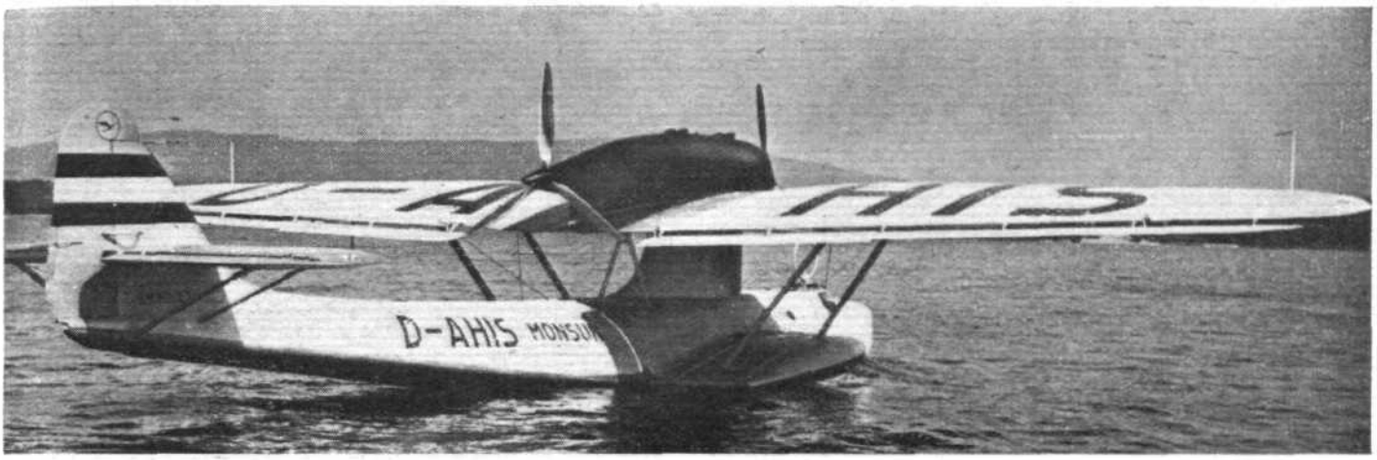
Medical Branch

Squadron Leader.—L. C. Palmer-Jones, to R.A.F. Officers' Hospital, Uxbridge; for duty as Medical Officer, 1.11.35.

Flight Lieutenant.—V. H. Tompkins, to No. 28 (Army Co-operation) Squadron, Ambala, India, 21.9.35

COMMERCIAL AVIATION

— AIRLINES —— AIRPORTS —



FOR THE SOUTH ATLANTIC : The latest Dornier flying boat for the D.L.H. mail service photographed on Lake Constance. This machine, which has Diesel engines, cruises at 124 m.p.h. and has a range of 2,485 miles.

THE WEEK AT CROYDON

Ten Thousand Hours of Channel Flying : A Question of Damage : Coals to Newcastle : Armistice Day Over the Channel

WHEN *Horatius* landed from Paris on Saturday at about 9 p.m. there were no flags or bouquets about, nor was the nearest R.A.F. band in full blast on the tarmac, The commander hurried down his gangway, through Customs, and so home, and that was that. Yet Capt. W. Rogers had just completed 10,000 hours of exclusively cross-Channel flying with passenger-carrying civil aeroplanes.

While on the subject of cross-Channel flying some of our old-fashioned friends who think it dreadful that firms such as Imperial Airways, K.L.M., and D.L.H. should make long crossings ought to meet people like Capt. Rogers and some of the senior pilots of the big firms. They would find them quite serene and untroubled about it. If the pilots do not worry, nobody else should do.

Minor Catastrophes

Sabena had extremely bad luck the other evening in wicked weather, when one of the Savoia-Marchetti pilots slightly overran a landing and did minor damage. It was nothing to worry about, as the news people were told. "Do you," asked a well-known Croydon man to a newsmonger, "fly off the handle and foam at the mouth when a train bumps into the buffers?" One newspaper wrote of "uprooted lamp standards" and of "the Air Ministry gunpowder store." Luckily, no mention was made of the secret flint instrument store where Government flint knappers work night and day. We may be a bit old-fashioned, but the airport is not lit with gas lamps, nor will the authorities relish having their pyrotechnic store described as though it contained charcoal and saltpetre.

The fun of the evening, however, was not provided by an aeroplane, but by the Air Ministry fire engine. This proceeded at speed to the scene of the minor contretemps, and came to no good at all through taking off and flying some distance over the edge of one of the small cliffs abounding. The fire engine was not, of course, needed, but if it had been the adventure would not have been so funny. It was not the driver's fault, for if a fire engine is expected to race across rough country—and the Ogaden district has little on our Airport in this respect—it should be provided with adequate lights to see whither it is wending.

Anyway, the final joke concerns a strong rumour that those incredible humorists, the Treasury, want to charge up the damage to the company whose aeroplane overshot. If my house catches fire the Mitcham brigade, having driven into Mitcham pond and blown up, and having left my premises to be gutted, would hardly have the nerve to charge me with damage to their engine and with the destruction of pond life—to wit, a couple of carp.

Capt. J. J. Percy, of Imperial Airways, has been seen at the Airport recently. He brought back a D.H. Dragon, the property of the Iraq Petroleum Co., from Cairo. This is being replaced by a Rapide, taken out East a week or so ago by Capt. Dudley Travers.

The fact that Croydon town now has its own direct air service whereby letters for Croydon are no longer taken to London for sorting, but go straight to Croydon, is interesting and may even improve the miserable lot of the air mail users at the Airport. In the past, people with offices at the Airport had their air mail letters from abroad taken, under their very noses, to London for sorting, shuffling, and brooding over at the G.P.O., whence they were returned by devious means after as many days, in some cases, as it had taken hours for them to cross by air from the Continent.

Messrs. F. R. McGuire and F. Thomas, aged twenty-one and twenty-six respectively, have wisdom beyond their years. They landed at Croydon on Sunday at dusk after a leisurely 12,000-mile trip from New Zealand. This had taken a month, and, quite amazingly, no idea of record-breaking ever seems to have entered their heads.

Amongst notable passengers last week were Princess Alexandra of Greece, Princess Pisitha Parisatra of Siam, Miss Pola Negri, and Mr. Huberman, the violinist, who flew to England to play at the Queen's Hall on November 8.

On Armistice Day Capt. O. P. Jones, 5,000 feet above the Channel, throttled back his engines and glided almost noiselessly for two minutes during the Silence, while his passengers stood in the cabin. He also reported, on the same day, a rare sight in the Channel, which his passengers also saw plainly. This was a waterspout some 2,000 ft. in height in action five miles south-west of Beachy Head. The show lasted for at least ten minutes, and Capt. Jones reported the phenomenon by wireless to the control tower, presumably so that anyone else in the vicinity could be advised.

A. VIATOR.

Commercial Aviation

"BLOCK TO BLOCK"

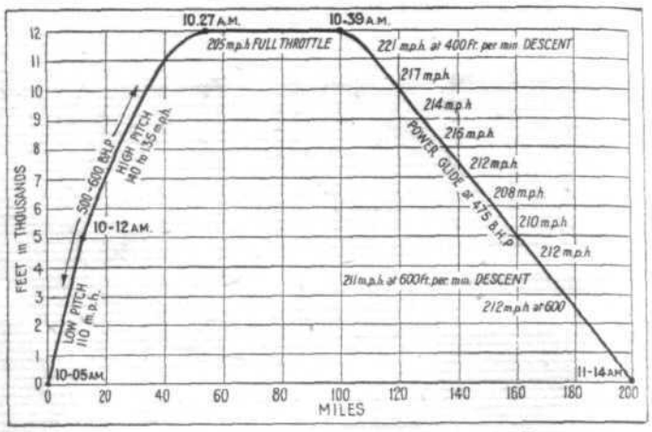
How the American Pilots Obtain Maximum Ground Speeds with High-speed Transport Types : The Need for a New Technique

SINCE the people over here are still somewhat sceptical of the "block to block" speeds which are scheduled on many of the American air routes, it might be worth while to consider some of the points which must be remembered by the pilot of the modern high-speed type which is designed to operate at considerable altitudes.

Intrigued by the article on the Vultee, which was published in *Flight* of October 3, a pilot, who has recently returned from the "other side" after six years in the States and Canada, has sent us a number of interesting charts. One is reproduced here, and all suggest that, as he explains, the "style and method of flying in the U.S. has entirely changed with the use of Boeings, Douglases, and the like," and that these fast machines require a new species of piloting skill if high ground speeds are to be maintained. This pilot does not speak without knowledge, since during the past four years he has flown the Montreal-New York service on which Vultees have been used since October of last year. During this period he was in close touch, also, with the various Douglas pilots on other routes.

The pilot's cruising chart for a Vultee used by American Air Lines shows that at no time does the cruising speed in level flight exceed 190 m.p.h., yet the average speeds obtained during three months of operation on the Montreal-Albany service show that the schedule (160 m.p.h.) was, more often than not, beaten by a very handsome margin. The slowest average on any journey was 133 m.p.h., and the fastest something like 200 m.p.h. The first average was registered on a journey in which the altitude never exceeded 2,000ft., with snow and ice formation, and in which a considerable detour was made. In general, the northbound and southbound services were flown at ground speeds of 170-175 m.p.h.

Among the charts were some dealing with the "block to block" speeds registered on various air lines such as T.W.A., American Air Lines, Eastern Air Lines, and United Air Lines, with Douglas, Boeing, and Vultee machines. In the case of the services flown with Douglas machines, the average operating speed works out at 162.3 m.p.h.; with Vultees it works out at 169.8 m.p.h.; and with Boeings at 154.7 m.p.h.



The way of a Vultee between Albany and Montreal.

The crux of the matter, however, is contained in the three graphs showing flights carried out by this pilot in a Vultee between Albany and St. Hubert Airport, Montreal—a matter of 200 miles. The most important point concerns the "power glide," which must be carried out until the airport is reached—allowing a thousand feet of descent for ten miles at a rate of descent of some 400ft. per min. Actually, the best altitude for a distance of this kind is about 6,000ft., but, with any journey of 400 miles or more, it pays to travel as high as possible.

In the graph which is reproduced, it will be noticed that the descent is commenced about a hundred miles from the terminus.

An Australian Extension

HOLYMAN'S AIRWAYS have now started their promised extension between Melbourne, Canberra and Sydney, using D.H.86s. The service is operated once each way on every week-day, while the Hobart-Melbourne service (*via* Flinders Is. or King Is.), with which it connects, is operated twice daily with one service on Sunday.

Air France Increases

FIGURES now available show that the Air France traffic for the summer of 1935 was considerably greater than previous figures.

3,574,000 commercial miles were flown by the aircraft of the combine, an increase of 100,000 miles over the previous summer; 42,076 passengers—an increase of 9,748; 154 tons of air mail—an increase of 42 tons; and 780 tons of goods—an increase of 69 tons over last summer—were carried.

Seasonal

DURING August for the first time in Heston history, the number of commercial aircraft movements equalled those of private machines. October figures show that this is, for the present, only true of summer traffic. The Jersey and Isle of Wight services carry a large proportion of holiday passengers and in consequence their figures suffer a considerable drop at the beginning of the winter. As these lines carry the greater part of Heston commercial traffic, the scales last month turned heavily in favour of private traffic, which shows only a relatively small decrease in winter.

Commercial traffic, in fact, dropped 53 per cent. since August, while private traffic has only dropped 7 per cent. This, of course, is no reflection on the air lines. It merely shows the seasonal nature of the present air-line traffic from Heston and the rather unexpected fact that the majority of private owners do not appear to have cut down their flying for the winter.

Compared with October, 1934, general traffic showed a 48 per cent. increase in October this year, and 38 per cent. more air-line passengers passed through the airport.

Paris to Madagascar in a Week

THE first through air mail from Paris to Madagascar left Paris on November 8, and is due to arrive in Madagascar Sunday, November 17. The distance covered on the route is approximately 8,000 miles. This new trans-African mail service has been established by Air France with Belgian co-operation.

It was announced last month that the French and Belgian service to Brazzaville would, on November 9, be extended across the Belgian Congo to Elizabethville. Simultaneously the French line operated by Rene Lefevre and Jean Assolant between Madagascar and Broken Hill has been extended from Broken Hill to Elizabethville, thus completing the final link in the chain for the through service.

About 170 lb. of mail and two passengers are on board and they will reach Elizabethville on Thursday. Here they will be met by Lefevre, who will continue the outward journey to Madagascar.

Atlantic Air Bases

LAST week Mr. Ivor McClure, the Operational Adviser to the D.C.A., travelled to Ireland to examine possible flying boat bases suitable for the projected North Atlantic service. It is suggested that either Cork or Bantry Bay, in the south, may be found to be suitable. At the luncheon of the Irish Society in London last week it was suggested that Londonderry would make a suitable base.

Mr. McClure has recently returned from Newfoundland, where Port Botwood has been tentatively approved as the western terminus.

Mr. C. H. Glendining, the chairman of the newly-formed Irish Transatlantic Corporation, has presented plans for an Anglo-American air service to members of the United States Government. The proposed route is from Londonderry to Sidney, Nova Scotia—a distance of 2,200 miles. It has been asserted that already 614 acres of land has been obtained for an airport at Londonderry and 900 acres at Sidney. The shares in the company are to be held equally by British and American interests.

The Grimes Landing Light

INTERESTED persons requiring further details of the Grimes landing light, referred to in *Flight* last week, should apply to the sole concessionaire, Mr. F. J. A Cameron, at 2, John Street, London, W.1.

A Lisbon-Seville Service

APPLICATION has been made by the Sociedade Aero-Portugueza Limitada to the National Air Council for permission to establish an air line between Lisbon and Seville. This has long been an aspiration of the Aero-Portugueza, and has been talked of since that company (sponsored by Air France) started operating the Lisbon-Tangier line.

Another Merlin for Tatas

DURING the past few weeks Miles Merlins have been ordered by Tata, Ltd., of Bombay, and by the Victorian Flying School, Melbourne. The Merlin, of course, was designed expressly for charter work and carries five people and luggage at a maximum speed of 160 m.p.h. on 200 h.p. It is fitted as standard with radio and landing lights.

When the Tata mail service started to use Bombay again at the end of the monsoon it was announced that passengers would be carried. The projected Bombay-Goa-Canaanore-Trivandrum service was due to be opened on October 29. This is being run once weekly in each direction on Tuesdays and Fridays for the south- and north-bound services respectively.

Serving the Goldfields

A NEW operating company, known as Airlines (W. A.), Ltd., has been formed at Perth, Western Australia, for the purpose of serving the goldfields A Monospar S.T.25 has already been ordered, with a spare Pobjoy engine, and a Gipsy II Spartan is also being purchased as a stand-by and for special charter work.

The route will be from Perth to Dalwallinu, Mt. Magnet, Cue, Reedys, Meekatharra and Wiluna, where the night will be spent, and then on to Mt. Sir Samuel, Leonora, Kalgoorlie, Southern Cross, and Perth. Alternating circuits will be made and the total round distance is 1,153 miles.

The line is authorised by the Transport Board of W.A., and the company expects to carry surcharged mail as well as freight and passengers. Mr. C. W. Snook is manager and chief pilot, and he expects that, after preliminary operations, more or larger machines will be purchased in the ordinary course of events.

Four Days to South Africa

FOR some time discussions have been taking place between the various Governments concerning the future of the air service between England and South Africa after the expiry of the existing arrangements in 1937, and in *Flight* of October 10 the detailed plans were given. Agreement has now been reached between all these Governments as to the general lines upon which the service will be operated.

The present intention is that the main through service, twice a week in each direction, shall be operated by flying boats *via* Egypt and the Sudan to Kisumu, and thence *via* Mombasa, Dar-es-Salaam, Mozambique, Beira, and Lourenço Marques to Durban. The Portuguese Government has concurred in the operation of this route in so far as concerns Portuguese territory. The boats are designed for a top speed which is expected to be in the neighbourhood of 190 m.p.h. and for a cruising speed of about 150 m.p.h. As a result it is hoped that the time occupied in transit between London and Durban will be reduced to four days.

There will be a branch service with landplanes connecting Kenya, Tanganyika and Northern Rhodesia with the main through service. Southern Rhodesia and Nyasaland will be given a connection by a similar branch service or services from Beira in order to effect the maximum saving of time.

There will, in addition, be a branch landplane service between the Union and Northern Rhodesia, with terminals at Germiston and Lusaka. It is proposed that this service shall be bi-weekly, one service being provided by the Union Government and the other under arrangements to be made by the Governments of Southern and Northern Rhodesia, on a reciprocal basis. By means of these branch services the existing internal landplane route through Kenya, Tanganyika and Northern Rhodesia and Southern Rhodesia will be maintained, in addition to the new flying-boat route down the coast.

Charter Changes

THE enlargement and changes in flying equipment and personnel have made it necessary to reorganise the boards of Commercial Air Hire and Air Dispatch. The Rt. Hon. Viscount Scarsdale and the Hon. Mrs. Victor Bruce have been appointed joint managing directors for Commercial Air Hire, whilst Mr. Eric Noddings has been appointed to the board of Air Dispatch.

On Saturday Mr. Follick, the Parliamentary candidate for Fulham, made a rush return trip to Plymouth in one of Commercial Air Hire's charter machines. This company has been making some interesting night flights lately.

More than fifty passengers have been carried during the past month on the Paris Dawn Express, and the daily load of newspapers has increased considerably in the last few weeks.

A New Navigation School

SINCE the Air Ministry and the operators are now taking a much greater interest in what can only be called theoretical qualifications, the classroom side of an air pilot's training is becoming much more important.

A new training centre, to be known as the Imperial School of Navigation, is shortly to be opened in the region of Notting Hill. Mr. C. W. Martin, who has an excellent record as an instructor of navigation, will be in charge, and the preliminary plans will depend on the kind of support obtained. The present suggestions are for a short, intensive, 2nd Class Navigators' course, starting in December, for the January examinations, with another longer course for those entering for their 1st Class Navigators' examination in March, and yet another course for "B" licence instruction.

Mr. Martin, apart from his long experience in the Service and with a well-known firm of instrument makers, was recently successful in passing 13 out of 15 pupils from the Imperial Airways' school at Croydon, and has been lecturing on navigation for the past two years. Pilots and others who are interested should write to him c/o Airco, Ltd., 18-20, Lower Regent Street, S.W.1.

Parallel Development

INFORMATION concerning the new Douglas and Boeing transports, the accuracy of which cannot be guaranteed, but which is believed to be reliable, has recently been received by *Flight* from America.

The Douglas should be going into service during the first half of next year. It is said that, following tests made by T.W.A. with their D.C.1, oxygen will be mixed with the air in the ventilating system of the new machines, permitting high-altitude flying without discomfort to the passengers. The experiments with the D.C.1 demonstrated that persons known to be particularly susceptible to the effects of height could be flown without any unusual feeling at 23,000ft. for periods of over three hours. The intention is not so much to do regular high-altitude flying as to permit a machine to climb above storms when necessary.

Actually, there will be two types of new Douglas transports. One will carry 24 passengers and a ton of mail in the daytime, and the other, a 16-passenger model known as the D.S.T. ("Douglas Sleeper Transport"), will provide sleeping accommodation at night. The gross weight of the latter model is said to be 24,000lb.

Two new type Wright Cyclone nine-cylinder supercharged radials giving 930 h.p. for take-off, and 800 h.p. at rated altitude, will be fitted. The span of the machine will be 95ft., the fuselage will be 75ft. long and 92in. wide, and the cabin will be 6ft. 8in. high. A cruising speed at 16,000ft. of 210-215 m.p.h. is expected, the figure at 10,000-12,000ft. being 170 m.p.h. The landing speed is expected to be about 65 m.p.h. With 24 passengers the cruising range should be 1,100 miles, and for night operation 1,600 miles. It is believed that the engines will have two-stage superchargers and it seems fairly certain that constant-speed, controllable-pitch airscrews will be employed.

It is expected that the new Boeing transports, about which few details are available, will cruise on 60 per cent. of their power at 200 m.p.h. A cruising range of 1,250 miles is hoped for (the 247 D. has a range of about 600 miles), and the new machines will carry 20 passengers instead of 10 as in the present Boeings. It seems that the engines will be Pratt and Whitney Twin Wasps of 850 h.p. each. The absolute ceiling with full load on one engine should be 11,000ft.

HERE and THERE

Sir Charles Kingsford Smith

BY the time these words appear in print the fate of Sir Charles Kingsford Smith, M.C., A.F.C., and his companion, Mr. J. T. Pethybridge, may be known.

Sir Charles Kingsford Smith and Mr. Pethybridge left Lympne for Australia at 06.28 hrs. on Wednesday, November 6, in the Lockheed Altair *Lady Southern Cross* on an attempt to beat the time of C. W. A. Scott and Campbell Black in the D.H. Comet. Next day, Thursday, they reached Allahabad at 18.25 hrs., being then only 2 hrs. 47 mins. behind the time of the Comet. After a halt of about an hour for refuelling and refreshment they left again for Singapore, and were seen over Calcutta at 21.06 hrs. Next day, Friday, 8th, they were expected at Singapore, but did not arrive.

Mr. Melrose, in a Gull, also bound for Australia, arrived and reported that at 02.00 hrs. the Altair had passed over him, being about 150 miles out to sea. Air Commodore Sydney Smith, A.O.C., Far East Command, ordered two Singapore flying boats of No. 205 (F.B.) Squadron to search for the Altair, and afterwards two flights of Vildebeests joined in the search. Mr. Melrose abandoned his own flight to use his Gull in hunting for his fellow Australian. Up to last Tuesday evening no trace of Sir Charles had been discovered, but all hope had not been abandoned.

Last Tuesday night it was reported that Melrose was three hours overdue from one of his search flights.

Death of W. G. Aston

FLIGHT regrets to record the death of Mr. Wilfred Gordon Aston, well known as an aeronautical and automobile journalist. He will be remembered for his association with *The Aero* in pre-war days, and subsequently as a member of the staff of *The Autocar*. Incidentally, he was a pioneer in the matter of illustrating semi-technical articles with small explanatory sketches. During the war, as an officer in the R.F.C. and R.A.F., he was attached to the Air Ministry.

A colleague of his recalls that somewhere about 1910 he sketched an aeroplane layout which formed an almost uncanny forecast of design as we know it to-day, down to almost every modern idea except the retractable undercarriage.

For Engine Research

THE Metrovick-Dodds Cathode-Tube Indicator, the interesting engine-research apparatus which was described in *The Aircraft Engineer* of July 25, is being demonstrated on the Anglo-American Oil Company's stand (No. 43) at the Commercial Motor Show at Olympia this week.

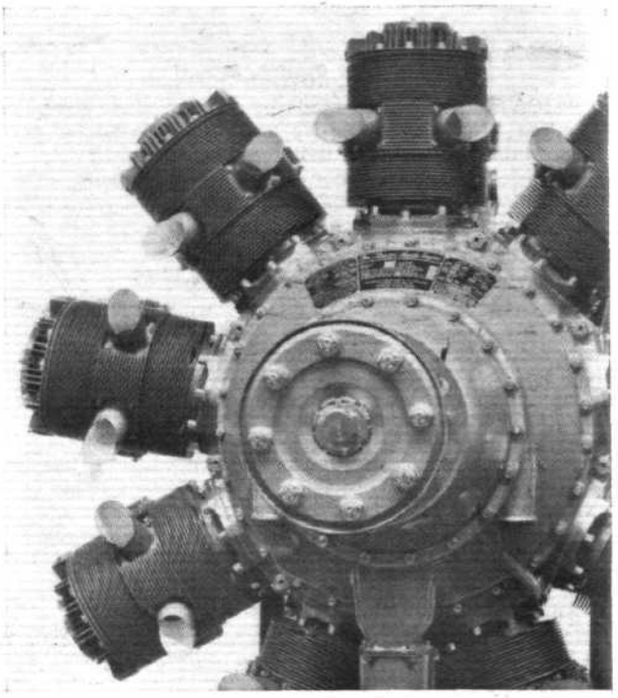
Recent Sleeve-valve Progress

A FEW weeks ago there was published in *Flight* a report on the results obtained with two Bristol Perseus III. sleeve-valve engines installed in *Syrinx*. When the pair were removed for inspection (it may be recalled that they "stripped" remarkably well) two more were installed, and when these engines were returned to the Bristol works for inspection recently, it was reported that they were in even better condition than the earlier pair.

The original two engines have now been reinstalled in *Syrinx*, and a total of 1,505 running hours under service conditions have been completed in four months.

It is reported that no maintenance has been necessary other than periodic examination of the sparking plugs under normal inspection routine, approximately every forty hours. Another point which has emerged from the tests, it is said, is the excellent condition maintained by the sleeves. One of the "Imperial" engines has now run a total of 740 hours, and the sleeves, which are made of a specially treated material, show an entire absence of wear. The oil consumption figures compare favourably with those obtained with the Jupiter poppet-valve engines, and the tests have revealed a distinct tendency for oil consumption to decrease as the running hours increase.

Between May and September 300 hours of flight testing was done with a civil-rated Aquila engine in Bristol Bulldog and Bullpup aircraft. This engine, it may be recalled, is intended for operation on 73-octane fuel, is rated at 500 b.h.p. at sea level at 2,600 r.p.m., and is capable of maintaining a continuous cruising output of 300-335 b.h.p. at sea level and 2,200-2,400 r.p.m. according to the installation and the type of aircraft concerned.



The Bristol Perseus sleeve-valve engine, referred to on this page.

The tests entailed 300 take-offs and comprised extended full-throttle runs at various altitudes, full-throttle level runs at 2,775 r.p.m. at 1,000 ft., full-power climbs up to 10,000 ft., fuel consumption tests at various boost pressures and altitudes, fuel flow tests, and long periods of cruising at 2,300 r.p.m. at high altitudes. Fuel and oil to specifications D.T.D.134 (73 octane) and D.T.D.109 were used throughout, and the average consumption figures maintained on test were 20 gallons per hour and 5¾ pints per hour respectively. Fuel consumption for normal cruising conditions is, of course, considerably lower than the figure given. It is stated that the condition of the engine after the tests was absolutely satisfactory.

NEW COMPANIES

In the notes below, for reasons of space, the "objects" of new Companies are usually somewhat abbreviated.

LUTON AIRCRAFT LTD. Private company. Registered November 4. Capital, £100 in 1,000 ordinary and 1,000 founders shares of 1s. Objects: To carry on the business of designers and constructors of all types of aircraft, components and engines, etc. The subscribers (each with 1 share) are: Eric F. Needham, "Phœnix," Oxford Road, Gerrards Cross, Bucks; Walter Bevis, Havelock Road, Warsash, Southampton. Eric F. Needham is the first director. Registered office: Faldo Road, Barton, Beds.

EAST MIDLANDS AVIATION COMPANY LTD. Private company, registered November 4. Capital, £1,000 in 10s. shares. Objects: To acquire the Northamptonshire Aviation Club, carried on at Sywell Aerodrome, Northampton, and to carry on business as aeronautical constructors, engineers, etc. Directors: Leo. G. Brown, 4, Stanton Avenue, Highlands, Northampton; Samuel P. Seddon, 58, Park Road, Kettering; Albert Chappell, 12, Britannia Road, Kettering; Frank M. Rouse, 98, King Street, Kettering; Joseph T. Bazeley, Cogenhoe, Northampton; Arthur Woodhouse Gardner, "Duncan House," St. George's Avenue, Northampton. Registered office: Post Office Chambers, 14, Abington Street, Northampton.

ELDERS COLONIAL AIRWAYS, LIMITED.—Registered as a "private" company on November 7, with a nominal capital of £25,000 in £1 shares. Objects: to work lines of aerial conveyances, particularly on the West Coast of Africa. First directors: Major Gerald F. Torrey, M.C., and Picton Hughes Jones (representing Elder Dempster Lines, Ltd.), George E. W. Humphrey, C.B.E., Col. Harold Burchell, D.S.O. (representing Imperial Airways, Ltd.). Registered office: Colonial House, Water Street, Liverpool.

ISLE OF WIGHT FLYING CLUB, LTD.—Private company, registered November 7. Capital, £100 in £1 shares. Objects: To carry on the business of instructors in flying. Directors: Ernest H. Byrne, Wm. A. Andrews. Registered office: Lea Airport, Lake, Sandown, I.O.W.

HESTON AIRCRAFT CO., LTD.—Registered as a private company on November 8 with a nominal capital of £30,000 in £1 shares. Objects: To acquire the undertaking of the Heston Aircraft Company, Ltd. (incorporated in March, 1929), and to carry on the business of manufacturers of and dealers in aeroplanes, engines, etc. Directors: Sir Norman J. Watson, Prindley R. S. Jones, George A. Lingham. Registered office: Heston Airport, Middlesex.